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K.Misono

INDEX

Introduction	-----	1
The types of traumata to human body (Maj. K.Misono)	-----	2
I Causes		
II The outbreak of damage		
Injuries (Maj. S.Miyazaki)	-----	8
Burn (Maj. K.Ohohi)	-----	11
I Outbreak of burn		
II Condition of patients		
III Affected area & state of wound		
VI Symptoms & course of burns		
V Prognosis		
Radiation disease (Part 1) (Maj. H.Motohashi & T.Hata)		16
I The appearance & the progress of symptoms		
II General progress of radiation disease viewed from the standpoint of stages		
III Principal symptoms of each stage		
IV Clinical examinations		
V Case reports		
Radiation disease (Part 2)	-----	41
I Effect upon appendages of the skin (Maj. K.Ohchi)		
II The disturbance of male generative function (")		
III Results from oral-surgical observation (Maj. M.Nakayama)		
IV Injuries of the visual organ (Dr. M.Nita & T.Fukuoka)		
V Injuries to the auditory sense (Maj. K.Narita)		
Pathoanatomical & histological investigation of radiation disease		53
(Maj. S.Ohhashi & K.Yamashina)		
I Summary of pathoanatomical investigation		
II Summary of pathohistological observation		
The effects on those who entered the bombed area after the explosion		
(Maj. M.nakayama & S.Hongo)	-----	76
I Investigation of soldiers		
II Investigation of civilians		
Influence of specific area upon human body	-----	82
(Maj. M.Nakayama)		

Radioactivity (Maj. K.Misono)	-----	77
I Test method & test material		
II Results of the investigation		
III Consideration of quantative data		
Discussion (Maj. K.Misono & H.Motohashi)	-----	94
Appendix (Maj. K.Misono)	-----	99

Figures & Tables (not contained in text)

Index

Fig. 1	Range of damage
Table 1	Effects of atomic bomb upon students
Table 2	Effects of the bomb upon troops under the Chugoku H.Q.
Table 5	Damage to the auditory organs
Fig. 6	Appearance of various symptoms according to dead & survivors
Fig. 7	Appearance of various symptoms
Table 12	Blood picture in 2nd stage
Table 13	Blood picture in 3rd stage
Table 17	bone marrow puncture in 2nd stage
Table 18	Bone marrow puncture in 3rd stage
Table 30	Laboratory data of patients in 2nd stage
Table 31	Laboratory data of patients in 3rd stage
Table 44	Results of oral-surgical investigation
Table 47	Results of pathological investigation in 1st stage
Table 48	Results of pathological investigation in 2 nd stage 3 rd
Table 50	Results of investigation on Ishiuchi villager
Fig.	White smoke
Photograph	burn
	Petechia
	Stomatitis
	Gingivitis

One Atomic Bomb dropped over the City of Hiroshima on August 6, 1945 had produced great damage to the locality and at the same time had brought a terrific shock to the whole world at large. From Aug. 6., hardly before the horrors of the bomb had subsided, the Medical Corps of the Army Shipping Division & Military Hospital present commenced active medical services & investigations.

The Army Medical College & 1st Tokyo Army Hospital had dispatched First Aid Squad to the area from Aug. 8. until Nov. 21., where they had undertaken consultation & investigations despite the post-war confusion & weather hindrance. Owing to the demobilisation of the Army that soon followed, the work had to be stopped & completely desirable results have not been realized. At present, earnest investigations comprising our highest medical authorities are in the process of publishing their most accomplished reports. We are presenting our last report of Military Medical Department, results of our close investigation together with those of 1st & 2nd Hiroshima, Fukuyama, Okayama & Himeji Army Hospital, with gratitude for the laudable efforts of the local medical committees.

THE TYPES OF TRAUMATA TO HUMAN BODY

The atomic bomb effects on human body are classified as injury, burn & radiation disease.

I Causes

The terrific energy that had produced intense effects on human bodies was caused by fission of the uranium atom at a height ^{above the ground} of 560 m., & was displayed mainly in the forms of blast, electro-magnetic wave (ultraviolet ray, visible ray, heat ray, gamma ray etc.) and corpuscular ray.

1. Damage by blast are:---

- (1) Direct damage by blast pressure.
- (2) Indirect damage by flying debris of buildings etc.

The strength of blast pressure at the center of bombing was 6 Kg per square centimeter. Its effect was extremely strong compared to that of other bombs. It showed some irregularity of effect & partial differences of power in the same power sphere by reason of topography, terrestrial features & the presence of solid buildings. As shown in fig.1, the radius of completely destroyed buildings was about 2 Km from the presumed center of bombing. (Number of Km. mentioned hereafter will represent the distance from center of bombing.) The radius of partially destroyed houses reached 3 - 4 Km. Most of the brick or stone structures within 0.5 Km were completely destroyed & those within 1 Km were partially destroyed. There were houses partially destroyed at a distance of 6 - 7 Km. There ^{were} broken window panes as far as Hataukaichi (12 Km), & kure district (20 Km). A soldier standing in the yard of the 2nd Army Hospital situated less than 1 Km north, fell headlong into an air-raid trench due to the blast. Another at wrecking work on the river bank near the Prefecture, 0.8 Km south-west, was thrown into the river. An officer in the yard of Military Preparatory School, 1.2 Km north-east was hurled to the ground; another officer issuing instructions in the yard of Shipping Signal Corps was whirled about 10 m; & at 9 Km south on the top of Ninoshima mountain the degree of blast was such as to blow off hats.

Besides the above indicated blast effects, the great amount of sand dust that filled the air was a decisive factor in the infection of wounds.

2. Heat ray, visible ray, ultraviolet ray:---

In most cases, the instant effect of heat rays was the production of burns. Heat rays at Minoshima was of a degree to cause some sense of warmth. Those burn cases requiring treatment had been within the limits of the 3.5 Km radius. Heat rays in many cases had caused burns not only on the exposed surfaces of the body but had penetrated through clothes & caused burns on the covered skin. Heat rays also effected scorching & setting on fire certain materials of dark color, (black, navy etc.,) fabrics, paper, timber ~~roof~~ straw roofs etc. A soldier's coat caught fire in the yard of Military Preparatory School & another soldier had holes burned in his coat in the yard of Shipping Signal Corps. Part of the fire that broke out in Hiroshima may have been caused by direct ignition but it was mainly due to secondary causes. But in our investigation among the surviving patients, we were unable to find any burns caused only secondary to flames.

3. Corpuscular ray, gamma-ray

Neutron, gamma-ray; & gamma-ray & beta-ray from artificial radioactive substances which originated from neutron action were causes of radiation disease. The district where neutrons directly affected human bodies was within 1.0 Km distance from the center of bombing. In districts further away gamma-ray had caused effects but the most severe cases of radiation disease occurred within 1.0 Km range. Severe cases occurred also within 1.5 Km, & milder cases within 2.0 Km from the center of the bombing.

As a characteristic effect of neutron & gamma-ray exposure, sheltered conditions such as buildings etc, caused great differences in the occurrence of radiation disease. For example, among the 95 workers of the Telegraph Station (7 storied) at Fukuromachi, 36 were killed instantly or were destroyed by fire, 53 died before Sep. 8., & 6 remained at the end of Sep., 5 of which were on the 3rd & 4th floors & had gone through the course of radiation disease. But 1 individual in the basement on the side opposite the bombing had no trace of illness & his w.b.c. was 8000 on 27 / VIII.

One of the two soldiers at their station together at Chugoku H.Q. (1 Km north) was in a concrete trench, the other outside of it. The latter complained of symptoms early & died of radiation disease on 29 / VIII.

the
The one in trench had no complaint, & his w.b.c. was 6600 & r.b.c. 4.24
m. on 28 / VIII. The strength of secondary beta-ray & gamma-ray from
artificial radioactive substances on the ground due to neutrons; is pre-
sumed to be of such degree as to have effects on human bodies for 2 -
3 days after the bombing in area around the center of bombing.

I The Outbreak of Damage

Owing to the vastness of the damaged area & because of the fact that
the Military & Civil Headquarters lost their functions simultaneously,
there are still points unclarified. Nevertheless on the basis of what we
ourselves observed & collected, we shall look at the matter from points
of view of damage, locality & stage.

1. From the view point of damage:---

(1) Injury

Most of the wounded patients were those who were indoors at the time
of the bombing. Cases of lacerations, contusion & glass splinter injury
were overwhelming in number. There were few survivors with severe fra-
ctures, internal injuries & blood vessel injuries. This no doubt, was due
to the fact that only those able to save themselves were brought into
the medical installations & those severely wounded were either instan-
taneously crushed to death or were left to die there. People out of
doors near the center of bombing, received injuries, such as contusions
by being thrown down by the blast; & also laceration & contusion from
flying debris. There must have been some injured directly by blast
pressure, but we could not determine this accurately. From the point of
view of distance, injuries were numerous near the center of bombing, in
the sphere of completely destroyed houses. At more distant districts,
outside the burn occurring zone, there were cases of injury from partial
destruction of houses & glass splinters. For example, there was a person
crushed to death in the Ujina Girls' College (3.2 Km) & a laceration
suffered at Ujina Training Engineering Corps (4 Km). It shows, among
other traumata, injury is apt to occur over a very wide area.

(2) Burn

Burn, caused mainly by heat ray, was the most frequent lesion experi-
enced. It occurred instantaneously, over a very wide area.

As heat rays ~~have~~ have little penetrating power, those under shelter
of buildings, etc., even near the center of bombing, received no burn.



The following example shows how the surface of the burn depended on the direction. Soldiers instructing at 2nd Military Hospital (1 Km north) & soldier training at Shipping Signal Corps (1.9 Km south east) were all burnt on the same side of body relative to the direction of bombing center, i.e. the side burned was directed toward the center. Burn cases were more numerous in people out of doors. But there were also burn cases among those who were indoors even behind panes of glass. There were cases of burn traced as it were on the surface of affected part, by colors & designs of apparel & by style of underwear. Needless to say, the exposed parts of the body were affected most. The degree of burn might be expected to be relative to the distance & presumably those near bombing center should be of greater degree. But it was a fact that survivors near the center of bombing had either no burn^{or} burns of small areas. Investigation on the survivors failed to reveal any relation between the degree of the burns & the distance from the center. The outline of the district in which burns occurred is comparatively clear. In districts outside 3.5 Km radius, we found no severe burn cases. As stated in the paragraph on injuries, it is for the same reason that we found no burn cases secondary to actual fires, despite the fact that great fires covered vast areas. Only those with strength enough to escape, or time enough to seek or obtain help & those who were saved have survived.

(5) Radiation disease

The very powerful penetrating power of radiation & gamma-rays enabled it to affect, in an instant, all the tissues of the body, the bodily cells responding in accord with their differing sensitivities, each type of cells having a certain incubation period before the development of evidences of function disturbed. The dosage of these rays decreases in inverse proportion to the direct distance from the bombing center & is influenced further by the absorption of air & other substances intervening between the origin & the subject. With such factors to cause differences in the appearance of symptoms, it was nevertheless true that under essentially the same conditions, symptoms were similar & occurred simultaneously. Those in the 1 Km zone who were exposed without adequate shelter showed severe symptoms within 10 days, beginning 10 / VIII; & those within the 1.5 Km zone with little protection, showed characteristic symptoms from the 16 / VIII.

In district out further than the 2 Km zone there were few characteristic cases. Symptoms of radiation disease depended greatly on the patients particular environment & on the individual himself.

2. Traumata from standpoint of locality

The effect of blast, heat, radiation & gamma-rays were strongest at the bombed center. As distance increased, firstly radiation & gamma-ray effects decreased, second^{ly} heat effects weakened & injuries secondary to blast monopolized the outermost circle.

At the center of the bombing, these 3 factors did not work separately but cooperated in affecting the victim, thus explaining the ghastly effect.

The occurrence of traumata may be classified thus : ----

0 ----- 1.5 Km	1.5 ----- 2.0	2.0 ----- 3.5	3.5 -----
Injuries	Injuries	Injuries	Injuries
Burns	Burns	Burns	
Severe R.d.	Mild R.d.		

Exact figures not ~~be~~ being available, this classification cannot be elaborated further statistically.

Primary students (Beginning of Sept. inst.)

Middle school students in labor service (Beginning of Sept. to beginning of Oct. inst.)

Investigation of effects on the above student group (see table 1.), showed the precise relation between distance from the center of bombing & subsequent deaths. Although we have no numerals to determine, those within the sphere of completely destroyed houses & in the area of fire must have been either crushed or burnt to death in great numbers. Those who even survived the day must have ~~been~~ died from burns, radiation disease or injury.

The traumata sustained by troops under the Chugoku H.Q. (Aug. 10-20 inst.) is shown in table 2. From the fact that there were deaths among those listed as missing, & that among those injured & uninjured ~~x~~ there occurred many cases of radiation disease with a high percentage of deaths, we may assume how tremendous the disaster must have been. (Owing to the Army demobilization no reliable documents were available).

About 600, 80 % of staffs & patients, were dead or missing at 1st Army Hospital (0.5 Km north) on the day of bombing; & that 487 corpses were taken out of the hospital ruins before Aug. 9. One survivor alone remained at the end of November (according to only staffs) .

These figures prove that there must have been a terrific number of immediate or early deaths from crushing & burn.

An active spirit of revival was seen through the city several months after the bombing & temporary huts were constructed. It was striking however to note that none of these huts were built within the 1 Km zone those having lived there previously having succumbed. Outward from 1.5 Km, as the distance increased the density of huts increased. This indicates further that the degree of damage was in inverse relation to the distance from the bombing center.

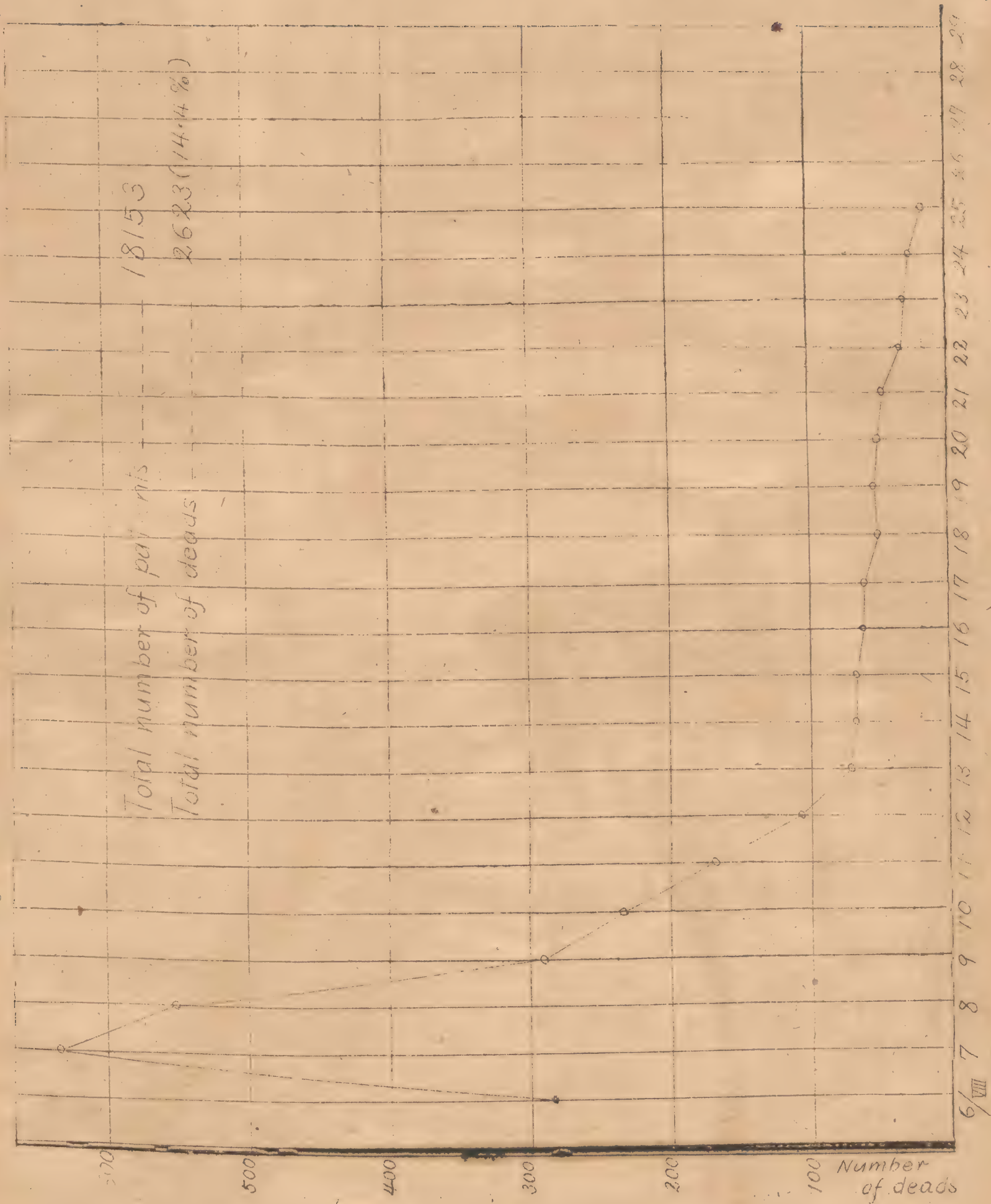
3. From the stand point of deaths.

The actual population of Hiroshima at time of bombing is unknown. (said to be 250000). Death until the beginning of Oct. may be estimated at over 15,000 & those injury & burn patients still requiring treatment at not less than 10000.

Most of deaths must have occurred on the actual day of the bombing due to crushings & burns. Within the following 10 days severe cases of burn, injury & radiation disease died; after 18 / VIII, mainly those with radiation disease died & since 10 / IX the number of deaths has decreased. Statistics of dead cases, per day, is shown in table 3. These figures apply to the Shipping Medical Stations where patients were accommodated (80 % were cases with burns) from the locality south of the line joining Hiroshima Station & Koi-achi.

The number of dead bodies handled by the Shipping Corps alone, near the center of bombing was 36000 (Aug. 13 inst.). The deaths among the 2 Army Hospital staffs were most numerous on the day of the bombing & at the end of Aug.. (see table 4)

Table 3 Daily deads in the medical department of shipping division





Tab #4 Damage of the Staffs of the II. Army Hospital (19/Nov.)

Rank \ Cases	Dead	Unknown	Survived	Absent at the explosion
Officers	7	-	1	9
Non-commissioned officers	13	-	4	1
Soldiers	40	-	13	4
Nurses	64	4	48	14
Servants & Maids	55	2	20	14
Service Doctor	95	23	4	-
Total	2174	29	99	42

Deaths during every 10 days
(II. Army Hospital)

Rank \ Date	6/Aug	10/Aug	20/Aug	30/Aug	10/Sep	20/Sep	30/Sep	10/Oct	20/Oct	Total
Officers	5	4	-	-	-	1	-	-	-	7
Non-commissioned officers	3	-	5	1	2	1	1	-	-	13
Soldiers	5	-	9	21	4	1	-	-	-	40
Nurses	25	1	1	4	22	2	-	-	-	55
Servants & Maids	21	5	13	7	4	-	-	1	-	51
Service Doctors	2	5	32	32	1	-	-	-	-	78
Total	61	12	46	65	33	5	1	1	-	224

INJURIES

It is worthy of notice that all injuries were caused directly or indirectly by violent blast not by fragment of bomb.

1. Among those wounded brought to the medical installations, no case was verified to have received injury of internal organs by blast pressure. This might be due to the fact:--firstly, people close to the center of bombing were killed instantaneously or burnt to death; secondly, many milder cases were overlooked by doctors on account of the confusion (routine work). There were many cases, who died within 2 or 3 days after injury, in spite of not having any wound of the body surface or with only burns of slight extent. The cause, is believed to be mainly the adverse effects of neutrons and γ -rays, and partly in the damage to internal organs by blast pressure.

Damage to the auditory organs by blast pressure. --

Among 371 patients investigated at Ninoshima Field Hospital (11% within 0.5 Km, 76 % within 2.0 Km, 13% within 3.0 Km from the bombing center), we found deafness in 19/371, rupture of the tympanum in 8/371, congestion of the tympanum in 9/371 (see table 5). Few cases showed symptoms of irritation, of the internal-ear, but most had middle ear deafness. All cases were injured on one side only corresponding to the direction of pressure.

Concerning disturbances of vision, investigation on 492 patients of Ninoshima Hospital revealed none with direct damage by blast pressure.

2. Patients who suffered indirect damage from blast accommodated in medical station had mainly fracture, contusion, injury from flying debris; such as fragments of collapsed houses etc & lacerations from glass splinters. These amounted to 20-30 % of all patients & constituted a smaller number than the burn patients (table 6).

Table 6.

	number of patients	%
burn only	146	50.2
burn and injury	48	16.5
injury only	97	33.3
total	291	

Points of difference of damage from other bomb.

(1) No case was injured by fragments by explosion.

(2) Even in a places at a great distance from the center of bombing cases of severe injury were found. (Fatal cases from the collapse of houses were found at points of 3.2 Km distant from the bombing center)

(3) Many cases of injury from window glass splinter were noted.

(4) Few cases of fracture were seen. (This may be due to the fact many severe cases lost their lives owing to shortage of rescue work and retarded first aid or were burnt to death) (table 7)

Table 7.

	number of patient	%
fracture	11	11.5
contusion contused wound	51	53.8
laceration by glass-splinter	33	34.7
total	95	

3. Characteristic features in the course of the injured are as follows.

(1) In the cases with complications of radiation disease; healing of wounds was prolonged coincident with the appearance of the typical symptoms; the granulation became anemic and edematous, bled easily or became dry because of unusual decrease of secretion; the borders of the wound were undermined; the growth of granulation tissue stopped and no tendency to heal was shown. In other cases, the wound enlarged gradually until death. In those who survived the granulation tissue improved again following recovery from the radiation disease.

(2) Patients who developed radiation disease as a complication were liable to bacterial infection, including not infrequently simple fractures as well as hematomas. (One case of simple fracture was infected with colon bacillus) Comparatively large numbers of cases of sepsis, multiple abscesses (5/169 of all patient in hospital from Sept.15--Oct.15) and erisipelas. (3/169 of all cases) were found. The precise number of patients with gas gangrene and tetanus infections is not clear. In these cases, local symptoms (redness, swelling, pain, etc.) are comparatively slight, temperature is not so high and leucocytosis is not striking either.

(3) Most of the patients with radiation disease did not show any remarkable increase of the neutrophile leucocytes even in the convalescent stage.

As shown in table 8, one case of erysipelas showed no considerable increase of leucocyte even on the 2nd day after the onset.

Table 8.

Erysipel with radiation disease
(7/X 2-3 days after onset)

name	w.b.c.	differential count						
		my.	met.	band-f.	seg.-f.	eos.	lym.	mon.
Oda	6700	0.5	6.0	24.0	33.0	2.5	22.5	12.5
Watanabe	14000	0.5	12.5	42.0	32.5	0	5.0	7.0

When the landslide crushed the ward of the Ohno Hospital on Sept. 17, convalescent patients with radiation disease recieved numerous contused wounds which later supperated. These cases showed no remarkable increase of neutrophilic leucocyte compared with the other usual wounded. (Table 9)

Table 9.

Infectionswound with radiation disease (28/IX)

name	w.b.c.		Differential count								
	(before)		my.	met.	band.	seg.	eos.	bas.	l.	M.	pl.
Kitasako	5200 ($\frac{1}{2}$ X)	4500	0	1.0	26.0	31.5	1.5	0	31.0	7.5	1.5
Matsuzaki	4600 ($\frac{1}{5}$ X)	6900	0	1.5	36.0	49.0	1.5	0	10.5	1.5	0
Hiyama	1200 ($\frac{1}{10}$ X)	5400	0.5	3.5	21.5	33.0	0	0	30.5	11.0	0
Suzuki	-----	6100	0	0.5	26.5	26.5	11.0	0	30.0	5.5	0
Hamai	1600 ($\frac{1}{5}$ X)	8900	0	2.5	27.5	39.5	2.5	0	17.5	10.5	0
Yamanaka	4200 ($\frac{1}{5}$ X)	7800	0	2.5	27.0	24.0	9.0	0.5	33.0	6.5	0
Tawara	5100 ($\frac{1}{5}$ X)	11500	0	1.5	20.5	50.0	1.0	0	23.0	3.0	1.0

Infectionswound only (28/IX)

Sunahara	-----	14400	0	2.0	33.0	32.5	20.0	0	9.5	3.5	0
Maehara	-----	13500	0	1.5	27.5	49.5	4.0	0	19.5	6.0	0

Radiationdisease only (28/IX)

Wada	-----	6500	0	0	11.5	63.0	3.0	1.0	15.5	6.0	0
Utsunomiya	--	1900	0	0	10.0	38.5	10.0	0	31.0	10.5	0
Miyake	-----	2900	0	1.5	20.5	45.5	1.5	0.5	18.5	11.0	1.5

(4) Some cases injured by glass splinters developed aneurisme of the a. radialis, a. occipitalis and a. frontalis.

BURN

I Outbreak of Burn

The season being Summer, people were very thinly clothed with much exposed body surface, & those at wrecking work were in light clothes.

At the instant of bombing a great multitude of burn cases developed over the vast area. The Shipping Medical Service in charge of most of the patients of Southern district of Hiroshima on that day reported 70--80 % burn cases among all patients accommodated. Most of the burn patients were those instantaneously affected by the powerful effect of the flash. Within our investigation limit, there were no burns caused by the ensuing fire that broke out within the city.

II Condition of Patients

1. Direction of body & posture in relation to the bomb.

Burns occurred on surfaces directly facing the flash at the time of bombing. Consequently each case had a specific area of burn according to the posture & direction of the body. For example, one group of Shipping Signal Corps troops at the Sendacho primary school yard (1.8 Km) drilling half naked was in files, taking a pause & listening to instruction, when a terrific flash occurred to their left. All laid on their faces except some who threw themselves a trench. All of them received burns on the left side of their bodies as described in fig..

2. Building concerned.

Among 74 burn cases accommodated in Ujina Hospital, those out of doors 64 (86 %) were greater in number than those indoors 10 (14 %). Those indoors were situated near some opening. Burns occurred of those behind panes of glass, although in milder degree; as was the case of burn patients affected while working in Hiroshima Savings Office 4th floor. (fig. 2)

3. Distance concerned.

Following was the result of investigation of patients at Ujina Hospital & 1st aid stations in & out of the city. (fig. 3)

Those cases with bullas, needing treatment for more than a week, were within 3.3 Km. The locality of 200--300 meters outside this area presented some burn cases which needed little or no treatment; although some had small bullas & erythema.

As a result of observation of the wounds of in- & out-patients of Ujina Hospital, we found slighter degrees of burn among those patients who had been near the bombing center. This finding seems very contradictory but it must be due to the fact that those near the center had mainly succumbed and only those with slight burns had survived.

This investigation was made mainly by the members of the Army Medical College & 1st Tokyo Army Hospital.

The staffs as follows:

Col.	Koichiro Toda	Otologist	Army Medical College	Aug.11 - 12
"	Ryuta Chikayama	Physician	"	Sept.10 - 25
"	Shizuo Yamagata	Ophthalmologist	"	Aug.11 - 12
Lt.Col.	Hideo Shimada	Surgeon	"	Aug. 8 - 17
"	Masanao Matsuki	"	"	Aug.11 - 12
"	Kazuyoshi Takikawa	"	"	"
Maj.	Keisuke Misono	Radiologist	"	Aug.12 - Nov.21
"	Saburo Miyazaki	Surgeon	"	Sept.10 - Oct.28
"	Taro Nakayama	"	"	Sept.10 - Oct.16
"	Kaoru Ohchi	Dermatologist	"	Sept.10 - Oct.16
"	Shoji Hongo	Sanitarian	"	Sept. 10 - Nov.12
"	Seiichi Ohhashi	Pathologist	"	Sept.10 - Oct.16
"	Isao Yumino	Dermatologist	"	Aug.11 -12
"	Hitoshi Motohashi	Physician	"	Aug.24 - Nov.21
"	Taro Takata	"	"	Sept.10 - Oct.16
"	Kyuichi Narita	Otologist	"	Aug. 8 - Oct.16
"	Akira Kambayashi			
"	Kiyoshi Yamashina	Pathologist	1st Tokyo Army H.	Aug. 8 - Sept. 6
"	Tohju Hata	Biochemist	"	Aug.24 - Oct.28
"	Tsutomu Matsunaga	Ophthalmologist	Military Office	Aug.8 -15
Captain	Kosuke Takatomi	Physician	Army Medical College	Sept.10 - Nov.12

005941

Medical Report
of
The Atomic Bombing
in
Hiroshima



296(2)
Army Medical College
The First Tokyo Army Hospital

Nov. 30. 1945

Medical Report

See
WN
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1945

Hospital

Army Medical Corps

British Forces in Germany

Nov 20 1945

Fig. 2. Outbreak of burn in Hiroshima
Saving Office 4th floor

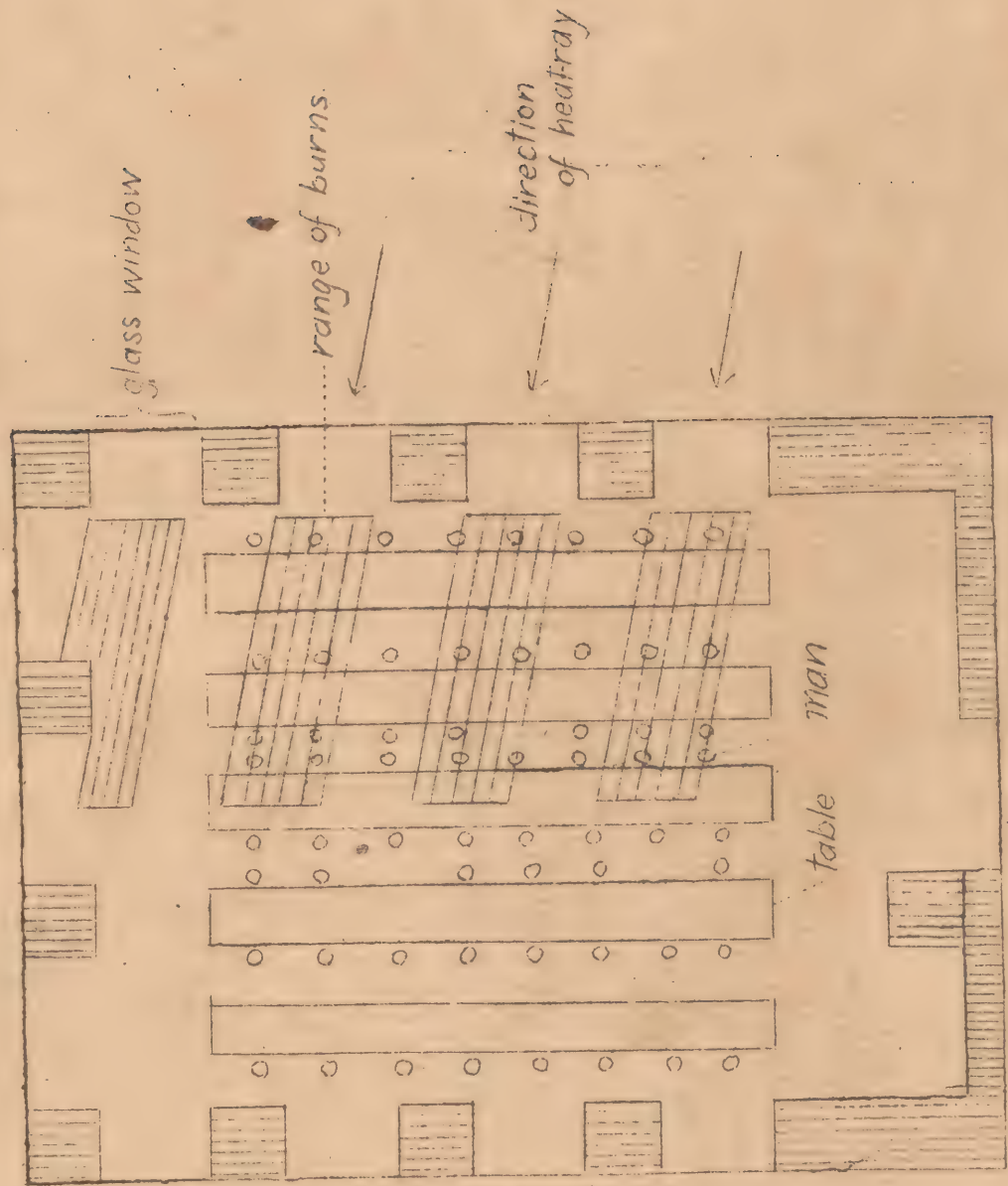


Fig. 3 Range of Heat-ray Effect.



尺之一分五

Note: ○ means a patient who needed treatment for more than a week

Apparel concerned.

Unlike X-rays, heat rays having very little penetrating power, & covered surfaces of the body were therefore usually unaffected. In some affected cases, differences of degree & area of involvement depended on color, thickness, texture of apparel & whether or not it adhered to the skin.

Investigation of Sept. 25 at the above Hospital showed the following (table 10

Table 10

Clothing	Burn	Distance from the center					Total
		0-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	
Summer-coat	naked & covered part	2	6				8
	only naked part	1	2	4		1	8
Summer-trouser	naked & covered part	2	1	1			4
	only naked part		4	1			5
Khaki-shirt	naked & covered part	3	12	22	1	1	39
	only naked part		1	1			2
White-shirt	naked & covered part	1	5	2	1		9
	only naked part		3	1	1	2	7
Black-shirt	naked & covered part		4	2			6
	only naked part						0
Total							89

It concerned 89 burn patients who were within the 3.0 Km range & who required prolonged treatment

(1) Those with burn only on exposed skin 23 (25.7 %)

Those with burn also on covered skin 66 (74.3 %)

Most burns on covered skin were milder in degree than those of exposed skin, but

one group (11/66) were actually more severe. This can be explained by the fact

that the exposed surface was affected instantaneously, where as the clothing having caught fire from the flash of the heat ray caused the skin under it to suffer the heat for a longer time

(2) As to the color of apparel, generally speaking, white absorbs heat the least & black the most. Consequently black and other dark colored clothes were very dangerous as they ~~burn~~ resulted in burn of the skin underneath. All those who wore black sustained burns beneath their clothes.

Khaki was next & white gave the most protection. One patient having worn black & white strips, received burns in the corresponding stripes. (see fig.)

(7) Burns were rare under thick clothing. 1 soldier (1.8 Km) with white working trousers & puttees was burned only in gaps between his puttees. Another soldier wore a khaki summer shirt with a flask strapped over his shoulder. Clearly the strap protected the skin under it.

Burns occurred through very thin white summer shirts at a distance of 2.3 Km but none were seen even at 1.5 Km, under khaki uniforms & shirt because of the combined thickness.

(8) Burned areas of unexposed parts were mainly at the shoulder, scapula, knee & side of elbow, i.e. such parts of the body, where clothes were in closest contact with the skin. On the other hand, irregular areas of burns, in spite of having the whole back equally flashed, were seen to occur where the clothing happened to adhere to the skin.

III. Affected Area & State of Wound

1. As before described, burns of all sizes were caused by various factors.

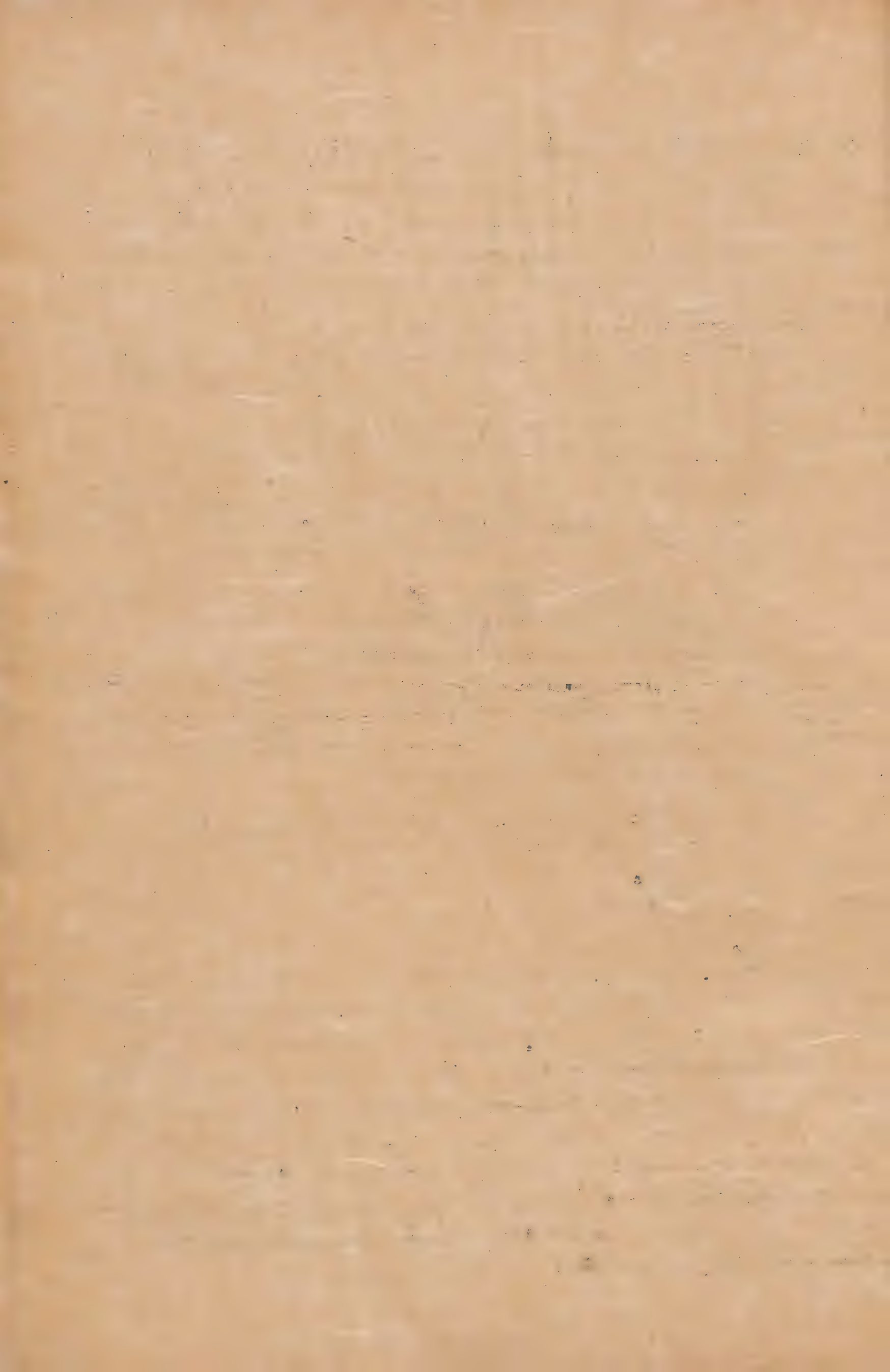
There were no burns on the side away from the center. The affected area sharply outlined. Table 11 shows result of investigation of affected area on 95 patients present on Sep. 25 in Ujina Hospital & 128 patients who died the first half of Sep. in Kameyama Hospital, a total of 223 patients.

Table 11.

	face	head	neck	chest	back	abdomen	arm & forearm	thigh & leg	whole body	half body	total
Survivors	42	24	43	12	44	1	72	25	0	0	276
Deads	107	15	18	27	31	6	95	23	5	3	330
Total	149	39	61	39	75	7	167	58	5	3	606

The most numerous burns were on the arm & face, then the back, neck & legs. Least numerous were those of head, chest & abdomen. This no doubt due to growth of hair hats & style of clothes. Some men with shorter hair showed burns on their head, whereas among women although many of them had much of their hair burned. The skin under it was usually protected. In the case of the men burns could be seen on heads with closely cropped hair or on bald parts.

2. There must have been those near center of bombing who had large areas of 3rd degree burns. They must have met instant death (crushed or by fire), or have died early from the effect of neutron, gamma-ray etc. In general, survivors presented surface burns, mainly of 2nd degree.



Next were 2nd degree burns having a small area of 3rd degree burn.

Investigation of 89 patients in Ujina Hospital at the end of Sep^t. revealed---

1st degree burn	4/89
2nd degree burn	36/89
3rd degree burn	15/89
(comparatively large area)	
2nd degree with small area of 3rd combined	34/89

IV Symptoms & Course of Burns

Symptoms & course of these burns coincided mainly with those of ordinary burns. Many patients told of instantaneous desquamation at the time of bombing. Most of the burns healed in the course of 3 to 4 weeks. Among the 97 patients present in Ujina Hospital at the end of Sep^t, wound healing in relation to distance from the distance from the bombing center was investigated^a.

The result was;--

Most of the cases within 1.5 Km radius showed slight burns & were healed between the middle of Aug. and the beginning of Sep^t. 36/43. On the contrary those cases in within 1.6-2.0 Km radius, took a longer time & even Sep^t. 15, 35 / 54 still showed granulating surfaces. From this we learned that these patients needing longest treatment were those in the last mentioned locality.

As was the case with injury, patients with the complication of radiation disease had a prolonged course. The growth of granulation tissue was retarded, & complications ensued from lack of resistance against infections. The course these unhealed wounds would take is still to be determined.

The scars of healed burns were usually faint; very few cases of keloid formation were noted at that time; no contractures resultant dysfunction of joints & no disfigurement. (But we have seen a few remaining disturbances of joint function due to atrophy through lack of after-treatment at 1st Aid Stations.)

Burns of the face healed mainly without leaving scars. As to the ear, there were many deformities owing to suppuration & ensuing perichondritis. There were a few cases of corneal clouding secondary to burn. Scars of the scalp were also very slight & we found no case of complete depilation. The scars were mainly dry, & often slight, violet-black pigmentation remained. Some~~of the~~ showed depigmentation & some, swelling of the capillaries. As a whole, the scars did not differ from those of burns in general.

There were cases of once healed scars again bearing small bullae & pustules but these cases were not ^{unusual} ~~common~~. During the period from the middle of Sept. to the middle of Oct., 3 cases of erysipelas developed among a group of 86 patients. This seemed a rather unusual occurrence & was ascribed to a common decrease of resistance.

V. Prognosis

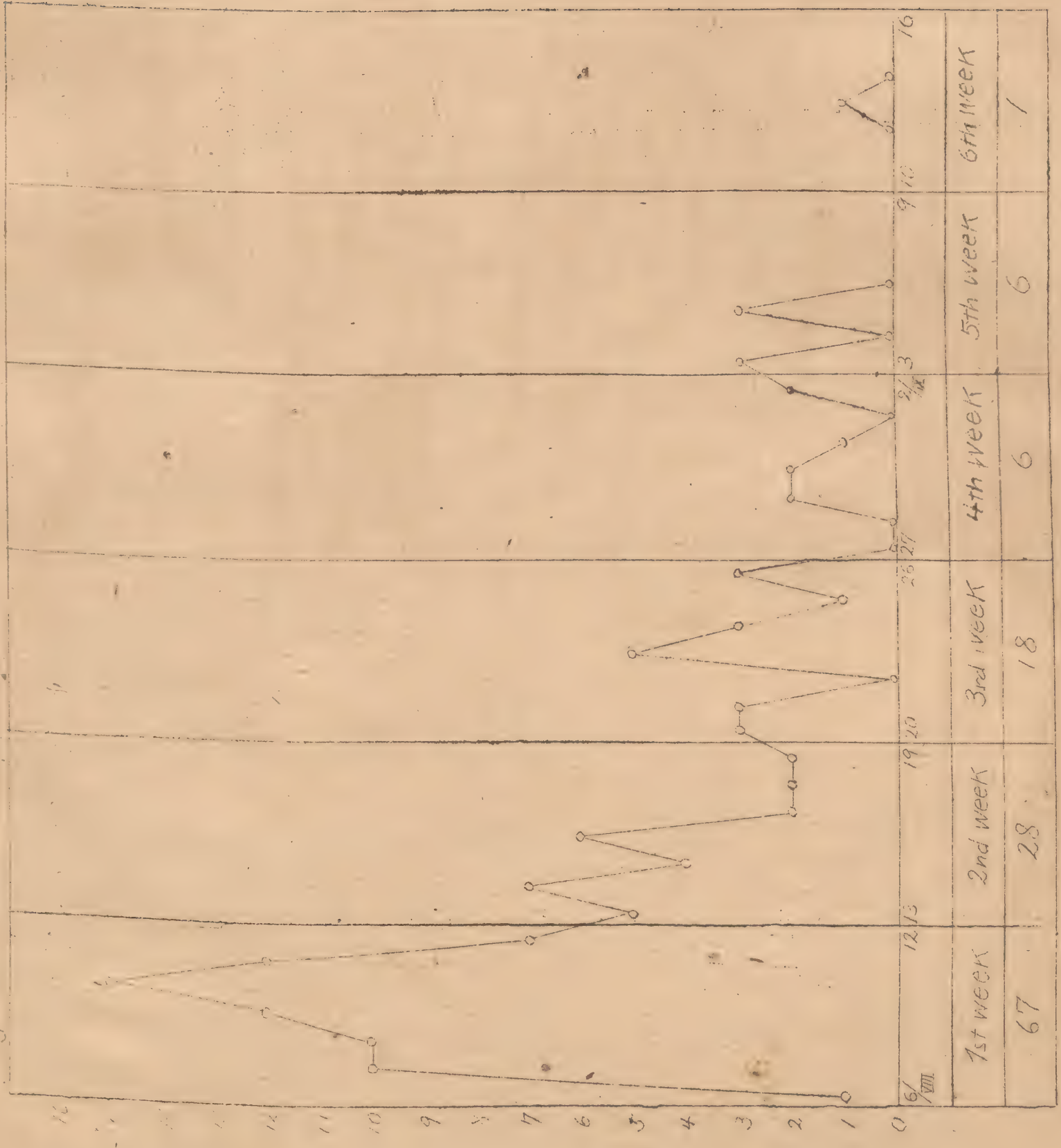
1. Burns caused by the Atomic bomb were similar to ordinary burn, most of them superficial & easily healed. When the patients at the same time affected by neutron, γ -ray or blast, depending on their distance from the bombing center, their prognoses became very different from that of ordinary burns.

Military Medical Installations where numbers of patients were first received, were unable to undertake minute investigation. The effect of neutron, γ -ray & blast not being apparent, were overlooked & all patients were treated alike as burn patients. Consequently, the prognosis of even slight cases of burns which usually healed easily, were not good.

For example, among 214 burn cases in ^{no} Nishima Field Hospital, 89 (41.2 %) died within 4 days; & that many other deaths followed, was sufficient to prove this.

2. Number of burn patients who died at Yamayama Hospital was 126 (burned at about 1.0 Km radius). ~~Table~~ Fig. 4 presents the statistics of daily deaths. 67 / 126 (53.1 %) within the first week --- 15 / 126 (11.9 %) on fourth day being the highest per day --- & 95 / 126 (75 %) dead within two weeks' time.

Fig. 4 Daily death of burned patients in Kameyama Hospital



RADIATION DISEASE (Part 1)

I The Appearance and the Progress of Symptoms

The following features characterized the symptomatology of radiation disease (damage due to radiation & gamma-rays)

1. Damaging factors affected the deep parts of the human body, doing damage to every tissue & organ simultaneously & therefore causing various symptoms to appear in a complicated correlation.
2. Recognizing that the dosage of radiation would vary with distance from the center of bombing, & the extent of protection, similar clinical symptoms were observed in people under similar conditions of exposure, except for some individual differences. The symptoms of one patient resembled very closely those of others similarly exposed.
3. When the conditions of exposure were different, the clinical picture might vary so greatly, at a particular stage, as to simulate many of other diseases.
4. There was an inverse relationship between severity of symptoms & distance from the center of bombing.

Accordingly, there are two ways of observing radiation disease clinically:

- (1) To group patients according to their distance from the center of bombing, & (2) To observe them from the view-point of clinical manifestation.

The former seems theoretically rational, but actually the intensity of radiation & gamma-rays effect was not always in exact inverse proportion to the distance from the center of bombing. Moreover, it would be impossible to assume a diagram of concentric isodosage curves, if the influence of many objects on the ground was taken into consideration. For example one case ended in death shortly after the bombing, where as another who happened to be with him was only slightly injured because of his more adequate protection. So it is not convenient to study clinical aspects from the viewpoint of distance alone.

As for the second method of study, involving observation in the various periods following the bombing, certain qualifications must be made. In general many clinical observation teams could not work through all stages, but only during some periods. Therefore, they have had to draw their conclusions from numerous data, collected by all other investigating teams as well. We believe nevertheless that here-in lie some of the strong points of observations from this viewpoint.



The gaps in our studies, that were made during the period from the end of Aug. to the middle of Oct., were filled by the observation at Army Medical Installations, such as Army Hospitals, their branch hospitals, first aid stations established by the Army & sick and wounded veterans sanatoria, etc..

In the observation from the viewpoint of stages of the disease due attention should be paid to the following points: (1) The development of clinical symptoms was so variant that other disease states were frequently mimicked. (2) We could not observe all clinical aspects of only one patient from the time of exposure to the rays to his convalescent state. The patients with severe symptoms at the start died fairly soon. With lesser exposure dosage the appearance of symptoms was postponed. We therefore were obliged to observe various aspects of clinical symptoms on many patients. (3) Great difficulties were encountered in the study of the progress of symptoms of those victims who, without being observed in detail, died within a brief span of time on account of very great exposure. In the rapidly fatal cases due to burn, the damage by radiation and gamma-rays was not taken into consideration. This prevented our recognition of the complete picture of the symptomatology of damage by the rays & obliged us to observe the cases unexpected. Particularly constituting a great hindrance to our study was the fact that hematological investigations were scarcely carried during the earlier stage.

II General Progress of Radiation Disease viewed from

The Standpoint of Stages

We have observed radiation disease in three stages divided according to clinical symptoms and the time of death.

The factors which caused the variation in the time of appearance of symptoms and the time of death, were mainly the radiation dosage as affected by such external conditions as distance from the center of bombing & the immediate environment, the presence or absence of burns and injuries, their secondary complications, such as suppuration, loss of blood & loss of fluids, the sites of injury, posttraumatic care & rest, & individual differences (age, sex & other unknown factors), and last but not least the presence of the incubation period specific to damage from the rays.

1. The first stage

In the majority of the radiation stricken victims nausea, vomiting, thirst, anorexia and fatigue were observed immediately after the explosion. Those who happened to be near the centre of bombing and have received a good deal of gamma-rays and neutrons died in a few days or at the latest in about 10 days. Their state was one of extreme exhaustion in spite of minor injuries or burns. In some of the cases reported by Sublieutenant Yanagi of the Eba Branch Hospital it was observed that the leucocytes in the peripheral blood had decreased greatly in number. Generally several days after receiving traumata, diarrhea occurred, often bloody which suggested bacillary dysentery, bacteriological investigation however, proved negative. In almost all cases abnormally high temperature were found just before death. We could not carry out precise observation on all total cases in this stage, for they died before real nature of damage of radiation upon the human body was clarified. Those who survived this phase or in who the serious symptoms of this stage did not appear despite exposure to a considerable amount of radiation, passed into the second stage.

2. Second Stage

The first depilation occurred about 10 or 14 days after exposure. (16/VIII-20/VIII) A step-like rise of temperature took place in the succeeding 5-7 days, closely followed by the advent of a group of such primary and secondary symptoms due to functional exhaustion of the hematopoietic system (as hemorrhagic tendency, tonsillitis, gingivitis and stomatitis etc.) and ending in death about 10 days later, namely 3-4 weeks after the initial trauma. But those in which the bleeding as well as the above mentioned symptoms were not so severe and improvement occurred, enter the 3d stage.

3. Third Stage

The cases who did not die during the 2nd stage ^{stage came} came into the 3d stage with anemia of a moderate degree, which characterized it and began to convalesce gradually about the middle of Sept. During this stage we saw cases which complication, such as sepsis, empyema, lung gangrene, etc. some of which ended fatally.

We could suppose the existence of such complication in the 1st and 2nd stages as well but the severe symptoms usually prevented their recognition. It may be said that due to diminution of protective powers, serious complication appeared even in the convalescent period.

III Principal Symptoms of Each Stage.

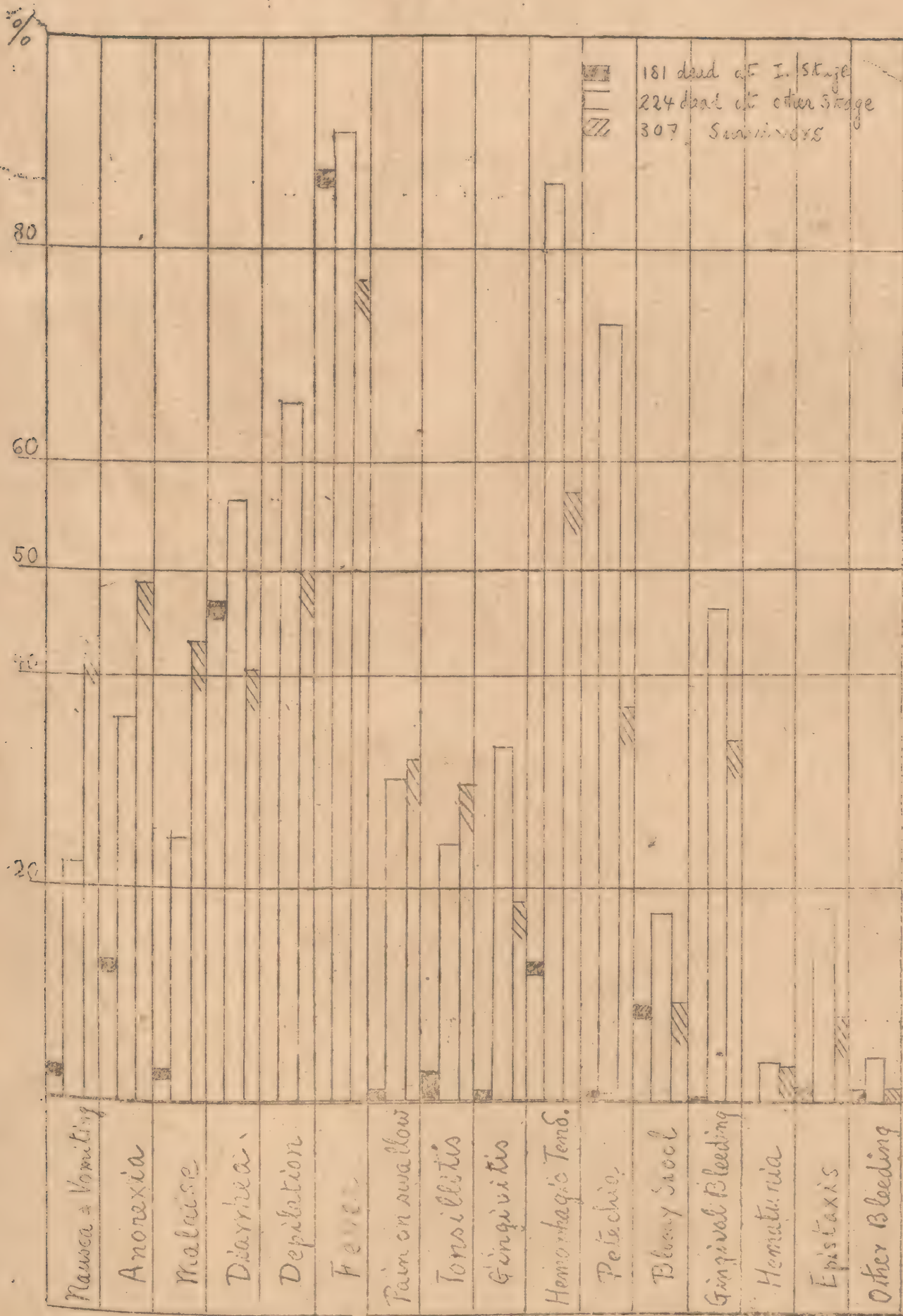
712 patients who were observed either by us or by other army medical installations are divided into: (1) those who died during the 1st stage, (2) those who died at other stage and (3) those who survived. The proportion in which various symptoms made their appearance is shown in fig. 5. The cases of the 1st stage seem to have fewer subjective symptoms; but that was probably due to insufficient records. The relation between the time of appearance of the symptoms of 278 survivors and 228 dead (for the most part servicemen who found ~~the~~ ^{them} ~~selves~~ within 1.5km distance from the centre of bombing) on whom comparatively detailed investigations were carried out, full clinical records were prepared, is shown in fig. 6 & 7.

1. The 1st stage

On the actual day of bombing all the medical installations were kept so busy treating patients that it was impossible for them to make detailed observations; that even those who died shortly afterwards with only small burns were treated simply as cases of burns, without recording the extent of their burns. Therefore it was difficult to evaluate the early symptom of radiation disease. But it can be concluded nevertheless that in all the cases of radiation disease nausea, vomiting, thirst, anorexia, fatigue, fever and diarrhoea were the characteristic symptoms in the early period. Nausea and vomiting were prominent symptoms on the day of the bombing, appearing in the proportion of 99/287 for survivors and 38/228 for the dead. Vomiting was usually limited to the day of the bombing, recurring 2-3 times in a day but over ten times daily in some instances. These symptoms appeared usually 30 ^{minutes} to 3 hours after the bombing, occasionally in relatively few cases on the next day, or days thereafter. The duration of the nausea was mostly a few days, but occasionally as long as 2 weeks.

Fig. 5.

Proportion of Appearance of various Symptoms



The thirst was often so intolerable that many patients drank water wherever they could find it. This was considered by some to be the cause of the diarrhea which appeared later. Anorexia was also remarkable on

the 1st day with an incidence of 100/287 for the survivors and 18/288 for the dead. Its duration was 2-3 days to as long as 18 days with an average of 1 week. Anorexia supposed to be closely related to feeding but there were many cases of anorexia in troops served a comparatively good meal on that day. The close relationship between anorexia and nausea, vomiting was observed too. Fatigue occurred at a high rate, 66/287 for the survivors and 13/228 for the dead. In the extreme cases the patients completely lost the will to work, sometimes dislike even the slightest bodily efforts. Its duration ranged from 7 to 10 days.

The low rates with which these symptoms occurred among those who died could be attributed to the fact that hospitalized, these patients were to seriously ill to be able to answer questions. But all army surgeons

in the 1st aid stations reported the same finding. Surveys were made on the clinical records of milder cases including 67 patients of Chugoku 111 and 121 garrison who were within 1km range of the centre and had been the observation since 10/VIII at Eba Branch Hospital and all branches of Hiroshima 2 Army Hospital, and 20 patients with only minor burns admitted to the Kushigahama Branch Hospital, with the following finding: From the actual day of the bombing to 4th day frequent watery

sometimes mucus-containing bloody diarrhea appeared with simultaneous rise of temperature as high as 38-40°C. In part the fever can be regarded as a reactive symptom of the burns and injuries, but the fever occurring after 10/VIII or 11/VIII is to be regarded as specific for

radiation disease symptom. To this was added thirst and general feebleness, and in 7-10 days death ensued. There were many cases which showed cerebral symptoms such as clonic convulsions, delirium etc. Half of the diarrhea cases had tenesmus and in some of them contracted left lower quadrant. Those with bloody stool resembled bacillary

dysentery and bacteriological investigation were made at the Hiroshima Army Quarantine Station with negative results. Of a total 181 cases who died before 17/VIII, 159 had fever, 85 had diarrhea including 10 cases with bloody stool, 22 had hemorrhagic tendency including cases with bloody stool

those with bloody stools, 2 with petechiae, 2 with epistaxis and 1 with gingival bleeding. Thus, fever and diarrhea were the features of the fatal cases of this stage. Sublieutenant Yanagi of the Eba branch hospital reported that w.b.c. counts were 300-400/mm³ in his observation before 15/VIII. Small number of cases already showed at the earlier part of this stage stomatitis, gingivitis, gingival bleeding, hematuria, epistaxis and rectal bleeding.

2. The second stage

1). Depilation began about the middle of the 2nd week to 5th week. In the majority of the patients it appeared on the 14th or 15th day as shown in fig. 5 & 6. 20/VIII in 38/287 of the survivors and 36/228 of the dead forming a remarkable inverted V curve. The duration was 3 days in the shortest case, 10 days in the average case. We found, however, that it ceases in the 6th week in cases which, later recovered, when we could observe the whole process. Depilation varied in degree but in many cases it came suddenly and the hair fell out in bundles. (see case report) The depilated hair: locked-hair-follicles. The site of depilation was usually limited to the scalp, but the beard, axillary and pubic hair were lost in most severe cases and the even more resistant lanugo hair and eyebrows in most severe cases. The rate of affection was 125/228 (54%) for the dead and 119/287 (41%) for the survivors. There were a few cases among those who died where no depilation occurred and a few with total depilation a good outcome.

2) Temperature rose mostly stepwise 5-7 days after the occurrence of depilation. The majority had a strong tendency towards febris continua but in serious cases showed elevation above 41°C and died in state of hyperpyrexia after several days. In cases which this period withstood and recovered the temperature returned to normal by lysis. The temperature curve resemble that of typhoid fever. The cases with high fever in this stage were 153/287 for the survivors and 156/206 for the dead. It is worthy of notice that antipyretics^a such as quinine, aspirin and others were ineffective against the fever. The patients did not perspire generally and had no chills but suffered from anorexia, fatigue and headache. There was no change in respiration. In cases which had

prognosis fever appeared earlier and prognosis was considered good if it began after the end of ~~the~~^{the} 4th week. The duration of fever ranged from 1 to 28 days in the majority being 8 days.

3) Hemorrhagic diathesis had a tendency to appear at the same time as fever or 1-2 days later but there were some cases where bleeding from the wound surfaces of injuries or burns preceded fever by a few days. Sometimes epistaxis and gingival bleeding preceded fever. Bleeding into the skin was the most common, followed by gingival bleeding, rectal bleeding, epistaxis, hematuria and hemoptysis in that order. Bleeding was noticeable, especially several days before death. Some died, however, with no sign of bleeding in the course of their ailment. Petechiae were recognizable all over the body surface, but especially on the upper half, (head, face, flexor surface of upper arm, and front of the chest). The size was usually that of a millet or pin-head, but sometimes purpuric lesions as large as a bean or of palm-size were seen. (see case report) Petechiae appeared sometimes on the conjunctiva, buccal mucous (tongue, jaw, and palate), and glans penis. No petechiae were observed on the palm or the sole. Its peak occurred about the fourth week in average, with no case developing lesions later than the 7th week. As days elapsed new and old lesions were mixed in a characteristic fashion. Mild cases had fever petechiae which ceased spread in the 5th week and began to vanish. Gingival bleeding was accompanied usually by gingivitis. Some of the several cases had bright red rectal bleeding at their worst period (the 4th week).

Though cases with epistaxis were few, ^{it} occurred so suddenly that we were often at a loss to treat them. In the period of fever, hematuria microscopic was recognized in a considerable number of cases, but macroscopically only in

a few cases (6 out of 206 deads and 4 out of 285 survivors). Hemoptysis

and hematemesis occurred infrequently. The duration of the hemorrhagic diathesis extended usually to the day of death in the fatal cases, whereas in survival cases it was 4-13, in average 9 days. The duration of gingival bleeding was 1-16 days, with an average of 6 days, that of rectal bleeding 1-13, average 4 days, that of epistaxis 2-3 days.

4) Changes in the mouth began to appear on the 3rd week, roughly parallel with temperature rise & reached their climax in the 4th week.

a. Gingivitis occurred with the rate of 29 / 287 for the survivors & 43 / 206 for the dead. At first only reddening was perceptible, but in a few days the gums became redish violet & swollen & associated with severe pain. They bled readily. Severe cases had necrotic ulcer, often with false membranes.

b. Tonsillitis made its appearance with the rate of 70 / 287 for the survivors & 44 / 206 for the dead to had aspect of a simple inflammation at the beginning, but when it progressed, suppuration, necrosis, false-membrane formation were added. The aggravated state of the tonsils persisted long after the general symptoms ceased to exist, presumably taking part in the generation of complications.

There were complaints of pharyngeal pain & pain on swallowing due to these oral inflammations (43 / 206 for the dead & 67 / 287 for the survivors). The duration of these inflammations was usually 7 - 10 days. Many of the necrotic ulcers caused swelling of the submandibular lymph glands & trismus, making it difficult to observe the inside of the mouth. That relatively few tonsillitis cases were reported among those who died was presumably due to this difficulty, for many cases of submandibular lymph glands swelling were noticed in this group.

As for differences in the occurrence of various symptoms between the survivors & the group that died in this stage, some were found as seen in Fig. 5. But it is also to be noted that no special symptom occurred in the fatal group exclusively. The occurrence rate of hemorrhagic tendencies was 135 / 287 for the survivors & 111 / 206 for the dead, showing only a slight difference, but the initial occurrence was earlier in the latter. The occurrence rate of petechia was 89 / 287 for the survivors, where as it was as high as 150 / 206 for the dead. It was the same with epistaxis too, namely 9 / 287 for the survivors & 34 / 206 for the dead.

In general, petechia & epistaxis of marked severity bespoke a bad prognosis. In the fatal cases the bleeding was severe & showed simultaneously various manifestations of the hemorrhagic diathesis.

3. The third stage

The 3rd stage, i.e. the convalescent phase was characterized by anemia. While other symptoms took a turn for the better in the 5 - 6th week, anemia persisted & was still frequent in the last week of September, as shown in table.

Some died on account of lowering of self-protective powers at this stage. We met not infrequently cases of chest complications, e.g. pneumonia lung gangrene, lung abscess, empyema, etc. They began to occur from about 10 / IX & the prognosis usually was not good. Some cases sepsis.

IV Clinical Examinations

1. Hematologic-morphological examinations

1) Picture of peripheral blood; (see table 12 & 13)

a) Red blood corpuscle

No detailed report as to the numbers of ~~of~~ red blood corpuscles & percentage of hemoglobin in the 1st stage was available. It was found that in the 2nd stage there were many cases of anemia of a moderate degree with values of 50 - 60 % of hemoglobin, some cases being as low as 30 - 40 %. Most had color indexes over 1.0, none below 0.7. Changes in r.b.c. were morphologically not remarkable. Occasionally large erythrocytes were found. Anisocytosis & poikilocytosis, etc., were all of slight degree. Polychromasia was hardly recognizable. In 14 of 44 cases nucleated blood cells were observed. Reticulocytes were few in many cases, & in some almost none were found in the agonal stage. With the approach of convalescence the red cells tended to increase, although in many of the severe cases this was not impressive. Jolly's body^{ies} & Cabot's rings were not seen, nor was basophilic stippling noted. In the 3rd stage there was a moderate decrease of hemoglobin & the number of red cells, with rare instances of a very marked decrease. The amount of hemoglobin ranged from 25 to 65 %, averaging 40 - 60 %. The decrease in the number of erythrocytes ran roughly parallel to that of the hemoglobin, the values being 1.35 - 3.82 million, mainly 2.0 - 3.0. The majority of the cases maintained color indexes at about 1.0, a few showed a downward trend, but in no case was color index greater increased.



The percentages of reticulocytes was 1.7 - 6.9, showing the significant tendency to regeneration, without any exceptions. The hemoglobin content of the r.b.c. was at the normal level, with exceptional decreases of slight degree, corresponding to the occasional tendency of the color index to be low. Although there was anisocytosis of a slight or moderate, or rarely high degree, & macrocytosis of a slight degree, no r.b.c. with a large amount of hemoglobin was found. Poikilocytosis was recognized in the majority of the cases, & polychromasia in half of them.

Nucleated r.b.c. were found in a small number of cases. They were all normoblasts. Basophilic stippling was found similarly. No Jolly's bodies & Cabot's rings were seen.

b) White blood corpuscles

All cases had leucopenia of a moderate or high degree. The decrease of leucocytes was most remarkable in cases with bad prognosis.

The 1st stage ----- Sublieutenant Kudo of the 2nd Army Hospital counted the leucocytes of the patients & the personnel of the hospital, who were within 1.0 Km. distance from the center of bombing, on Aug. 11 & 13 with the results shown in table 14. Decrease of leucocytes is to be noted.

Table 14

	0 1.000	- 1.000- 2.000	2.000- 3.000	3.000- 4.000	4.000- 5.000	5.000- 6.000	6.000- 7.000	7.000-
Severe injury or burn			1			1		
Moderate injury or burn		2	3		1		1	
Slight injury or burn				1	3		2	2
Healthy service- men						1	1	1
Total		2	4	1	4	5	4	3

Another series of counts was done on the personnel of the Chugoku H.Q., who were either at work without any traumatic lesions or receiving treatments on account of slight injuries, on Aug. 13 with the result of next table.

Decrease of leucocytes was evidenced in subjectively healthy men.

Table 15.

	2.000- 3.000	3.000- 4.000	4.000- 5.000	5.000- 6.000	6.000- 7.000	7.000- 8.000	8.000- 9.000
Healthy per- sonnel	3	3	2	5	14	5	7
Slight injury	3	2	10	5	5	3	5
Total	6	5	12	10	19	8	12

The relation between the number of leucocytes & vomiting (nausea), one of the main symptoms in the 1st stage, was shown in the following table, which indicates that where there was vomiting (nausea), there was decrease of leucocytes to a high degree.

Table 16.

Vomiting (nausea)	2.000- 3.000	3.000- 4.000	4.000- 5.000	5.000- 6.000	6.000- 7.000	7.000- 8.000	8.000- 9.000
absent		1	6	7	17	8	10
present	6	4	6	3	2		2

Sublieutenant Yanagi of the Eba Hospital reported that a remarkable decrease of leucocytes (the number being not more than 300 + 400) was observed in the agonal stage of the patients who died due to diarrhea & fever. According to the leucocyte counts carried out by the Ninoshima Field Hospital on Aug. 12 on 17 persons who were farther than 2 Km from the center of bombing & had no burns, the number of leucocytes was over 5.000 in all cases.

The 2nd stage ----- In general, with the onset of typical symptoms the number of leucocytes decreased significantly. For example, the daily counts of an officer who found himself at the Chugoku H.Q. (within 1 Km from the center of the bombing) at the time of the bombing was 6200 on Aug. 8., 4800 on Aug. 12. & 2200 on Aug. 28. In the case of an officer who was injured at Dobashi (0.9 Km west of the center) it was 3800 on Aug. 24., 2200 on Aug. 26., 1600 on Aug. 31., 1000 on Sept. 2., & 500 on Sept. 6. (fever since Sept. 3.). There was a close relation between the change of the number of leucocytes & the course of the fever. In general, the tendency of the number of leucocytes to increase after descent of temperature was stronger than that of the r.b.c. In cases with bad prognosis, the decrease of leucocytes was extreme.

In one case the number of leucocytes was 44 per 1 cubic millimeter, terminally. In the majority of the cases it was below 2000.

The differential count of the leucocytes was very difficult to determine, owing to the small number of cells, sometimes only ten leucocytes were found on entire slide. In the majority relative lymphocytosis was noted. Of course the absolute number decreased remarkably. In general, the lymphocytes exhibited retrogressive changes, sometimes the rim of cytoplasm was very small, sometimes the cells were so large as to suggest young forms. No particular change in azur-granules was recognizable. The decrease of neutrophilic leucocytes was of a high degree; the remarkable decrease simulated the so-called agranulocytosis. Retrogressive changes were striking. There were many cases in which basophilic granules, vacuole formation in the protoplasm & nuclear debris were observed. No great change was found in nuclear segmentation. In some of the severe cases remarkable shift to the left of the polymorphonuclear series was found. In comparatively many cases myelocytes were identified; in one case myeloblasts were observed. With the approach of the 3rd stage leucocytes increased in number with a striking shift to the left. Eosinophilic cells had a tendency to decrease or disappear, but with the approach of the 3rd stage they tended to increase. Nothing certain can be said about basophilic cells. Monocytes were increased, but we wish ~~not~~ to refrain from saying anything about it. Few plasma cells were observed.

The 3rd stage ----- The leucocyte counts varied from 1,700 - 9500, of which ~~cases~~ below 4000 were 1 / 3 .

Cases with neutropenia were few, the majority having a normal or high count. In the majority shift to the left was evidenced; often it was to a high degree. In some cases myelocytes were observed. In some, toxic granules were increased remarkably. In a small number giant cells & excessive nuclear segmentation were observed. Lymphocytes always increased: neither in their absolute value, nor in their relative value. In some cases lymphocytes decreased evidently. Eosinophiles increased relatively as well as absolute value. This tendency became marked with the lapse of time when relative eosinophilic cells increased. Monocytes were relatively increased & their absolute number increased too in some cases.

No particular increase of plasma cells was observed & no particular changes in basophiles.

The waxing & waning of the r.b.c., w.b.c. & hemoglobin in the three stages are shown in the cases indicated in fig. 8.

b) Blood platelets

The 1st stage ----- No detailed report was available.

The 2nd stage ----- In general, blood platelets decreased remarkably. Blood platelets of the cases with hemorrhagic tendencies numbered several thousands, usually below 50,000. During convalescence the restoration of blood platelets was quick & striking. In some cases anisocytosis of blood platelets was observed in the peripheral blood, as well as giant blood platelets & platelets with excessive nuclei.

The 3rd stage ----- Slight decrease was recognized. In the majority of cases blood platelets had returned to normal or showed such a tendency the size & the structure were normal with the exception of a few cases with giant platelets.

2) Picture of bone marrow punctures (see table 17 & 18)

The 1st stage ----- No detailed report was available.

The 2nd stage ----- Cells numbered 2,000 - 5,000 in the majority of the cases, in some 2,000 - 3,000. This is a significant decrease in comparison with the normal value of ~~ap~~ around 100,000. In slide preparations few cells were seen. Particularly, in severe cases it was found that bone marrow cells of young type were barely recognizable. Lymphocytes & reticuloendothelial cells increased. Plasma cells in every stage of maturations were observed. As convalescence drew near, young bone marrow cells increased in a comparatively short time as myeloid regeneration occurred.

A remarkably small number of cells of the r.b.c. series was found in the severe cases with bad prognosis, showing complete inability of production.

A remarkable increase of erythroblasts was observed in some mild cases during the convalescent stage. Young r.b.c. in this stage involved giant mother cells that could be taken for megaloblasts. The arrangement of chromatin was so fine, with 3 - 5 nucleoli in each nucleus that it was often apparently difficult to differentiate them from megaloblasts. But no stages of megakaryoblastic maturation could be found.



Fig

Table 8 - No. 1

The change of red blood corpuscles, white blood corpuscles and haemoglobin.

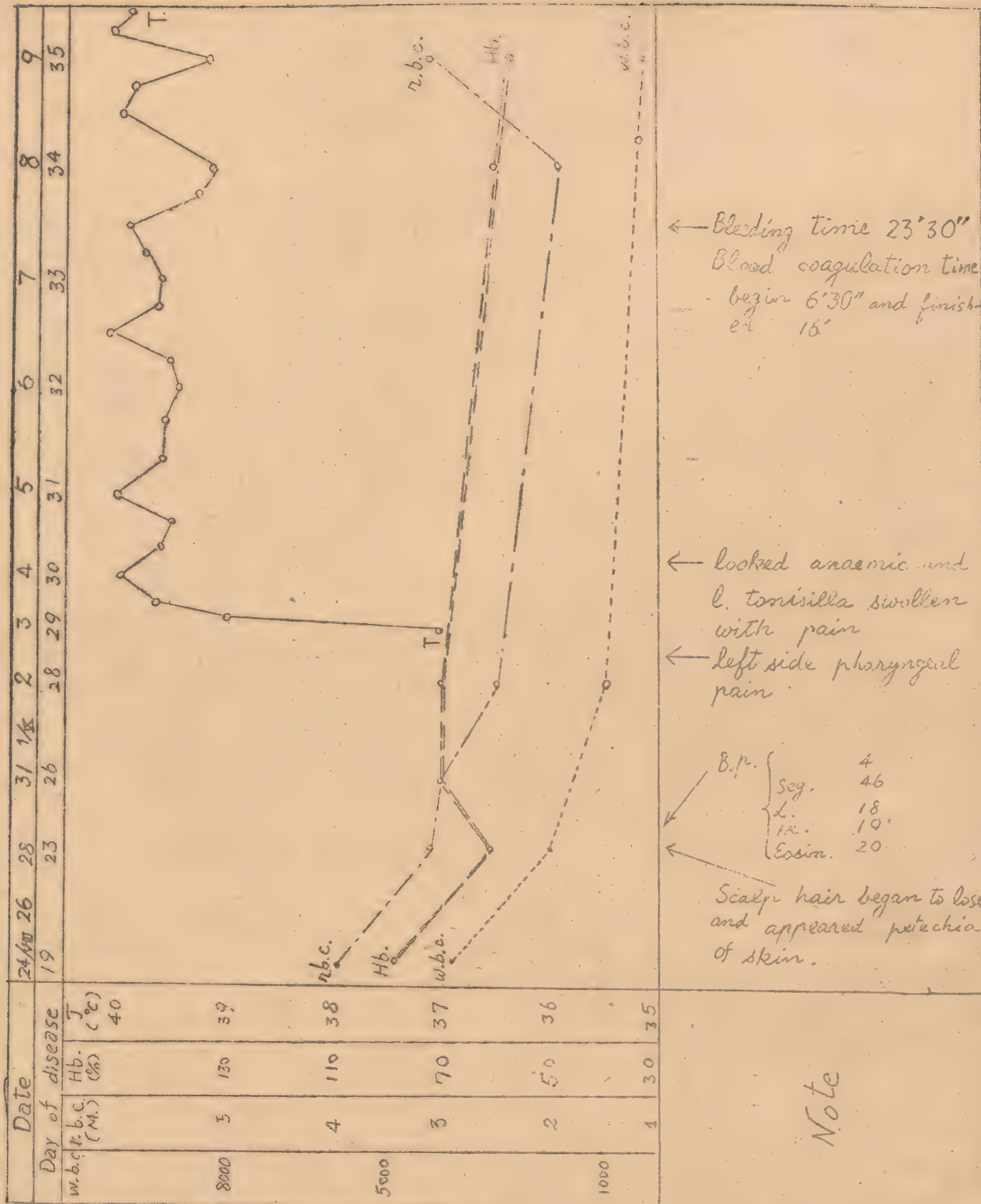
Case 1 (Observed at the 1st Tokyo Army Hospital)

Major Yamamori Higuchi
(Headquarter of the 13th Army Shipping Division)

Distance from the centre - 1.5 km
at Minami Kannoncho

Indoor at the time of explosion
laceration of chest, left arm and left thigh

---o--- Temperature
---o--- haemoglobin
---o--- red blood corpuscles
---o--- white blood corpuscles



Note

← Bleeding time 23'30"
Blood coagulation time
begin 6'30" and finished 16'
← looked anaemic and
l. tonsilla swollen
with pain
← left side pharyngeal
pain
B.p. {
 Syst. 4
 Diast. 46
 Pulse 18
 Essim. 10
 Essim. 20
Scalp hair began to lose
and appeared petechia
of skin.

Fig.
Table 8 No. 2

Case 2 (observed at Saijo Sanatorium)

Shigetaro Yamamoto

Distance from the centre :- 1.2 Km
indoor at the time of the explosion
slightly wounded

13/VIII Hyperpyrexia appeared and vanished
25/VIII Scalp hair began to lose, pharyngitis
28/VIII Hyperpyrexia (not so high)
1/IX Gingival haemorrhage, petechia appeared

— Temperature
— Haemoglobin
— Red blood corpuscles
— White blood corpuscles

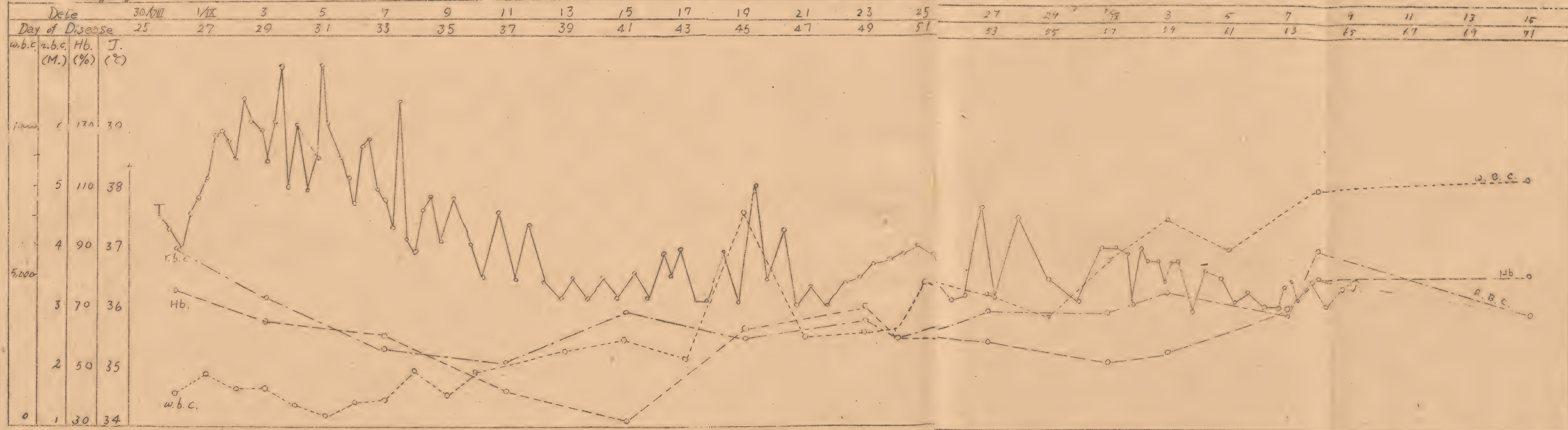


Fig.

Table 8

No. 3

Case 3 (Observed at Nimeji Army Hospital)

Sublieutenant Hiroshi Tanaka (Army Headquarter)

Distance from the centre 1.2 Km

indoor at the time of explosion

wound of left ear and left forearm

Course to the admission

17/VII admission because of wound

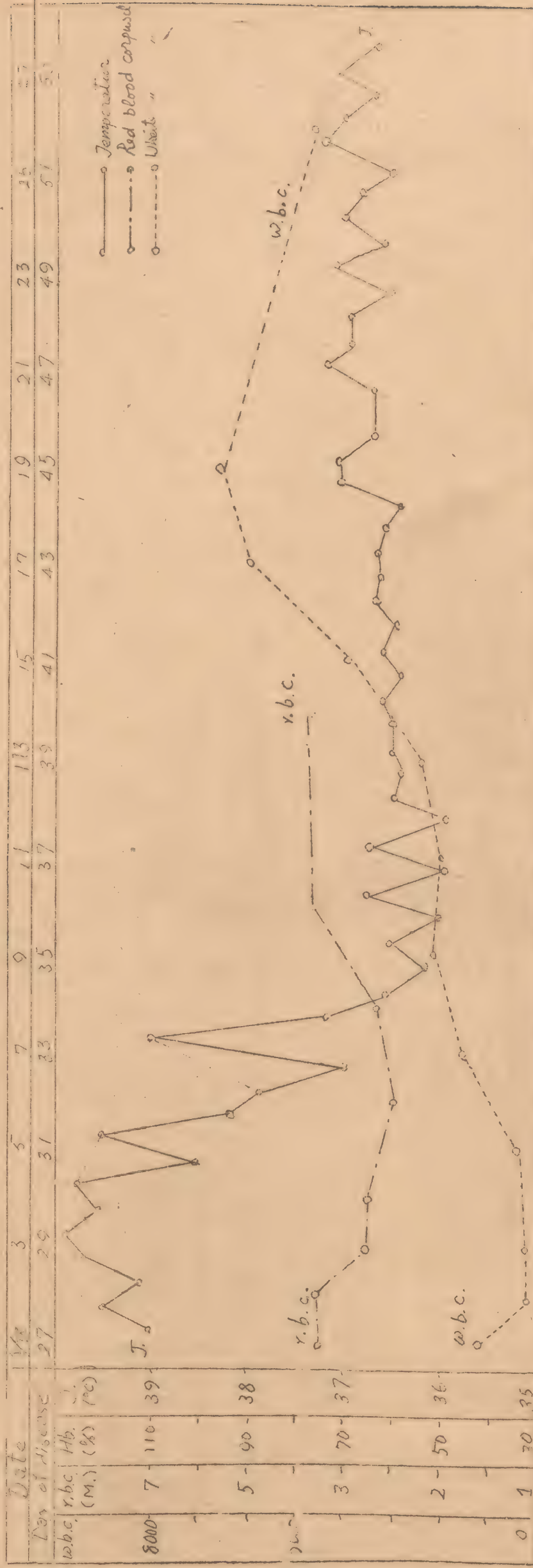
12/VIII discharged, general exhaustion

15/VIII discovered the depilation

25/VIII hyperpyrexia 38°C

29/VIII pharyngeal pain, sore throat, impossible to eat,

It is unclear when petechia had appeared.



Note

← Sedimentation 100 mm H of r.b.c.
 ← Bleeding Time, 17'
 ← Bleeding Time 6'30"



It was noted that the appearance of giant r.b.c. was in accord with the rise of color index of peripheral blood. The number of megakaryocytes was remarkably small; in some cases retrogressively shrunken megakaryocytes were found.

The 3rd stage ----- Nucleated cells tended to be normal or increased in number in the majority of the cases. In a small number of cases they were definitely decreased. In the latter group striking decrease of leucocytes in peripheral blood was noted. The number of nucleated cells seemed not to be related to the degree of anemia. In some cases nucleated blood corpuscles were still few. There was no case with a high percentage. In the majority of cases they were polychromatic normoblasts. No macroblast was identified. In a small number of cases nuclear segmentation was observed. Reticulocytes were increased in parallel with those in the peripheral blood with a slightly higher rate than the latter. Neutrophilic leucocytes of the bone marrow did not show a low rate even in the cases in which the number of leucocytes in peripheral blood was decreased. Of the neutrophilic leucocytes, band shaped nuclear cells had the highest rate, metamyelocytes having the next, showing no evidence of disturbance in maturation.

Eosinophiles increased greatly in parallel with those in peripheral blood. In some cases these were still few. No particular change in basophiles was observed. No case with a particularly high rate of monocytes was encountered.

The number of lymphocytes ran parallel with that in peripheral blood.

Megakaryocytes were not decreased notably & failed to show any particular morbid change.

Reticulum cells & plasma cells had a normal percentage & there was no case in which they had a high rate.

2. Chemical examination of the blood :

1) Sedimentation rate of r.b.c. (Westergren's method)

The sedimentation rates of r.b.c. were accelerated extraordinarily, 100 mm/60' and more, and did not parallel the degree of anemia.

This phenomenon was the most striking & specific finding in radiation disease.

For the sedimentation rates of patients in the 2nd & 3rd stages, see table 19.

Table 19

Sedimentation-rate	2nd stage		3rd stage	
	Num. of patients	dead	Num. of patients	dead
0-----20	1	0	0	0
20-----40	1	1	5	0
40-----60	1	1	4	0
60-----80	1	0	1	0
80-----100	2	2	5	0
100-----120	2	2	4	0
120-----140			3	0
140-----160			3	0

The curves of sedimentation rate of patients in the 2nd & 3rd stages are shown in fig. 9.

2) Bleeding time (Duke method)

The bleeding time, which was studied first in the 4th week when hemorrhages were most marked, was prolonged. In some cases it was increased to 30'.

Prolonged bleeding time indicated an absolute bad prognosis. In the 7th week the bleeding time became normal, (3'-5'), in those cases which survived.

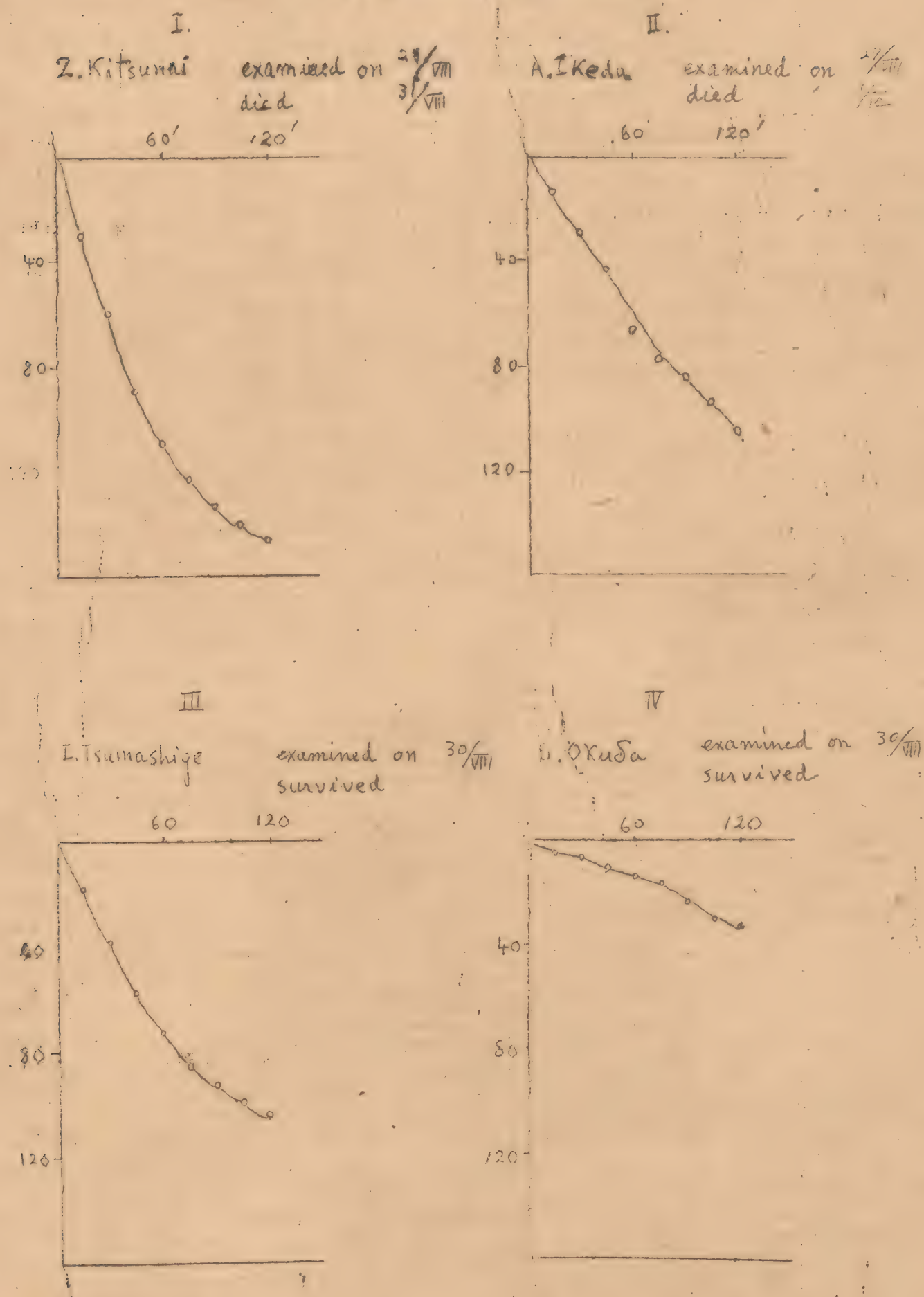
Table 20

Name	Date	Bleeding-time	Petechia	Outcome
Osura	28 / VIII	30'	many	died
Sato	"	28'	"	"
Morita	"	18'	moderate	"
Kitsunai	"	15	many	"
Takano	"	12'	a little	"

3) Coagulation time (Sahli & Fonio's method)

The coagulation time was determined first in the 4th week. The beginning of coagulation was only slightly delayed but its completion often was prolonged

Fig. 9. Curves of Sedimentation rate



greatly, occasionally to 30 - 40 minutes or more. The prolongation of coagulation time paralleled the degree of development of petechia, and indicated a bad prognosis. In cases which recovered the coagulation time was less prolonged.

Table 21

Name	Date	Coagulation time		Petechia	Outcome
		Beginning	Completion		
Moriseko	2 / 1X	11'30"	23'30"--	many	died
Hashimoto	3 / 1X	9'	41' ---	"	"
Onoe	"	8'30"	31'	moderate	"
Tanabe	"	12'	35'30"	"	"
Takahashi	"	9'30"	28'---	"	"
Horiuchi	"	7'30"	30'30"	"	"
Matsumoto	2 / 1X	7'30"	20'30"	a little	"
Takano	"	6'	15'	no	"
Sumuoto	3 / 1X	8'	14'	no	"
Nemoto	"	7'	18'30"	no	"
Okuda	2 / 1X	4'30"	7'30"	a little	survived
	23 / 1X	4'20"	10'20"	no	"
Okita	2 / 1X	6'30"	9'	a little	"
	24 / 1X	4'15"	8'15"	no	"
Kufuma	2 / 1X	10'	16'	a little	"
	24 / 1X	2'	7'30"	no	"
Tsumashige	2 / 1X	8'30"	16'	no	"
	24 / 1X	5'	7'30"	no	"

4) Resistance of r.b.c. (Ribier's method)

Resistance of r.b.c. was determined in 12 cases in the 4th week & in 22 cases in the 7th week. Even in the severe cases who had many petechias & died 1 - 2 days after the examination, the resistance of r.b.c. was normal. Judging from this fact there was no relation between the hemorrhage & the resistance of r.b.c.

Table 22

Name	Date	Minimal R.	Maximal R.	Petechia	Outcome
Chiba	1 / IX	0.38	0.28	many	died
Moriseko	6 / IX	0.42	0.38	"	"
Nagashima	1 / IX	0.40	0.30	moderate	"
Kitsunai	"	0.38	0.32	"	"
Ikeda	2 / IX	0.36	0.32	a little	"
Ishida	1 / IX	0.40	0.32	"	"
Motoyama	2 / IX	0.42	0.34	"	"
Takano	7 / IX	0.38	0.32	no	"
Okita	4 / IX	0.42	0.36	a little	alive
	26 / IX	0.42	0.32	no	
Okuda	30 / VIII	0.40	0.36	a little	"
	26 / IX	0.44	0.34	no	
	4 / IX	0.40	0.34	"	
Ikeda	26 / IX	0.48	0.36	"	"
	2 / IX	0.42	0.34	a little	
Kuruma	27 / IX	0.52	0.32	no	"

5) Resistance of capillary (negative pressure method)

Resistance of capillary decreased in the 5th week but returned to normal in the 7th week. Even in the 7th week those patients who still had leucopenia continued to show a decrease resistance. Since the resistance of the capillaries was parallel to the count of the w.b.c, it may have been one of the factors in the occurrence of hemorrhage.

Table 23

Resistance of Capillary

Name	Date	l. (mmHg)	r. (mmHg)	v.b.c.	r.b.c.	lb
Yanimoto	28/IX	80	80	1300	1.11	26
Nishihara	"	80	70	4300	1.72	32
Matsuda	"	80	90	1300	1.64	35
Misao	"	120	140	4500	1.72	33
Kurakami	27/IX	130	110	1700	2.81	54
Kamakura	"	130	120	3200	2.6	48
Nakamura	"	130	150	2900	2.26	46
Nagasaki	"	260	260	5300	2.64	51
Hosokawa	"	260	260	5800	2.59	47
Sakurai	"	250	250	9500	2.61	50
Muncoka	"	200	200	9200	3.82	65
Ikeda	"	160	170	7900	2.65	51
Kuruma	28/IX	260	260	6700	2.94	48
Okita	13/IX	100	80	1400		
	27/IX	260	260	4600	2.79	51
Okuda	13/IX	140	120	2200		
	27/IX	200	200	4100	3.45	56
Okamura	16/IX	220	220	4300		
	27/IX	180	200	5400	2.2	44
Kunimoto	16/IX	170	170	2400		
	27/IX	240	240	3500	3.21	55
Utsunomiya	14/IX	190	190	5500		
	27/IX	220	230	8900	2.43	42

3. Serological examinations : (see table 31)

1). Takata reaction

There were 10 positive cases among 28 examined during 17/IX-30/IX,
Half of the positive cases had anemia (r.b.c. - 1.0 - 2.0 m). It would be
seen that a positive Takata- reaction was related more closely to the
degree of anemia than to the degree of leucopenia.

2). Icterus index (Meulengraecht's method)

In general there was no change during the period 10/IX-31/IX.

3). Serum Bilirubin (Hijmans van den Bergh's method).

Among ²¹28 cases examined during 17/IX-30/IX, there was no direct positive
reaction but 4 cases showed an indirect reaction, and these cases had
marked anemia at the time.

4). Non-Protein Nitrogen in blood (Kowalski's method)

23 cases examined during 31/IX-30/IX had non-protein nitrogen values
below normal: minimal 13.3mg/dl, maximal 24mg/dl; 18 cases were under 20mg/dl.

5). Chlorides in blood (Ruszynak's method)

Normal values in general were found in the 3rd ^{stage} stage.

6). Sugar in blood (Hagedorn's method)

Normal values were found in the 3rd stage.

7). Napia reaction

Only negative reaction were obtained.

4. Urine : (see table 31)

Urinolyses of 117 patients were done, 88 complicated by burns or injuries
and 29 without manifest burn or injury during 18/IX-30/IX . Result were
as shown in table 24.

Table 24

	without burn or injury 29 number of positive cases	with burn or injury 88 number of positive cases
Albumen	2	12
Sediment	1	5
Urobilin and /or urobilinogen	28	55
Urobilinogen (Ellich)	20	42
Urobilin (Schlasinger)	17	20
Diazo- reaction	2	8
Indican (Jaffe)	10	30
Sugar	0	0
Bile pigment	0	0

a). Even in the positive cases quantity of albumin was small. In the sediment on occasion there were noted a few granular and hyalin casts, w.b.c. and r.b.c.

b). Urobilin and /or urobilinogen.

In all of the cases of radiation disease save one test for urobilin etc. in the urin were positive, but in the complicated cases urobilin was positive only 63%.

Degree of the quantity of urobilin and /or urobilinogen was parallel to the anemia as shown in table 25.

Table 25

r.b.c. (million)	number of cases	Degree of urobilin and /or urobilogen					total	%
		+++	++	+	±	-		
1.0-2.0	13	0	1	6	3	3	10	77
2.0-3.0	44	5	4	10	14	7	33	80
3.0-4.0	46	0	1	12	17	16	30	65
4.0-5.0	17	0	2	5	3	7	10	51
5.0-	1	0	0	0	0	1	0	0

c. Diazo reaction

Diazo reaction was positive in only 10 cases. (7-9%)

d. Bile pigment

Jaundice was observed in a few cases. The occurrence of jaundice in the patients of several hospitals and relation between jaundice and prognosis is shown in table 26.

Table 26.

Hospital	Number of patients	Number with jaundice	%	outcome
Ujina	491	2	0.4	died
Kushigahama	211	1	0.5	"
Eba	1041	1	0.1	"
Kaneyama	405	1	0.2	"
Saijo	170	2	1.0	1 died 1 alive

Appearance of jaundice thus indicated a bad prognosis. The urine of ¹²²122 cases was tested by Gmelin method in the 7th week and all were negative.

e). sugar

In the 7th week all urines were negative for sugar

d). Indican

In the 7th week 34% were positive for indican.

5. Stool:

a). Occult blood (table 27)

Even in the 3rd stage stool were positive for occult blood in a relatively large percentage of cases.

Table 27

Method	without burn. number of positive cases	%	complicated by burn or injury. number of positive cases	%
Benzidin	12	44	31	35
Guajac	4	15	--	--

b). Triboulet reaction

In 18 cases of 24 the Triboulet reaction was positive. It was positive more often than the tests for occult blood.

c). Parasites and ova

Parasites and ova found as following:

Ascaris	18/116
Anchylostoma	1
Tricoccephalus	2
Coliamaeba	3
Lambria	1
Trichomonas	1
Iodineamoeba	1
Entamoeba nano	1

6. Bacteriological examination: (see table 28)

1). Blood

a) Gall culture

Gall culture from the blood of the patients who had symptoms of radiation diseases especially high fever, was done on 30/VIII for 160 patients, 4/IX 3, 23/IX 5. The result was all negative.

b) Mixed culture (Borillon)

Mixed culture was done for 19 patients. Positive result of it was following:

Streptococcus haemolyticus	1
Streptococcus	1
Bact. coli	1
Gram positive diplococcus	2

In positive cases were found a few colonies on each plate. These cases all died.

2) Stool

a. From the 1st stage on there were many patients with mucoid bloody diarrhea who had symptoms suggesting bacillary dysentery and bacteriological examination of stool was done by Lieutenant Kawakami (HQ. of

Shipping Division) on 200 such patients seen in ^S several first aid stations. Only one case had a positive culture Shigabacillus being found on 22/VIII. In the same stage one case with positive culture of Flexner bacillus was found among 5 patients with diarrhea in the Fukuyama Hospital.

b. In the 2nd stage patients with watry or bloody diarrhea appeared again.

Stool specimens were taken directly from the rectum and were streaked on Endo-medium and Drigalski-dysentery medium. This was done on 30/VIII for 160 patients and 4/IX for 17. All culture were negative for salmonella dysentery bacillus.

c. Stool culture was done in all patients with radiation disease in Ujina Hospital on 23/IX and 7/X. Results were negative.

3) Widal reaction

On 1/X and 7/X widal reaction was tested in 10 cases. The blood of one case was positive to a dilution of 1/1600. The titer of agglutinins for paratyphoid A bacilli was abnormally high in every case at the first examination but on repeated examinations all were normal. It was considered likely that the original results were due to the use of an old strain of organism.

Table 28

Date	Number of test patient	Test material	Purpose of Culture	Method of Culture	Result	Examined by
16/VII	200	Stool	Typhoid Dysentery	Endo-m. Dysentery-m	Shiga bacillus 1	Lieut. Kawakami
30/VII	16	Blood	Salmonella	Bile culture	Bac. coli 1	Maj. Hata and Lieut. Kawakami
			Pyogenic bacillus	Mixed culture bouillon	Str. haemolyticus 1 Str. viridans 1 Coli bac. 1	
		Stool	Dysentery Typhoid	Endo-m Dysentery-m	(—)	
4/IX	3	Blood	Salmonella	Bile culture	(—)	Lieut. Kawakami
			Pyogenic bac.	Mixed culture bouillon	Gram positive Diplococcus 2	
	17	Stool	Dysentery Typhoid	Endo-m Dysentery-m	(—)	
23/IX	100	Stool	"	"	(—)	Lieut. Kawakami
7/IX	5	"	"	"	(—)	Lieut. Kawakami
30/IX	1	Pus from Empyem Kidney	Pyogenic bac.	Microscopic	Streptococcus (+)	Maj. Hata

7. Gastric juice (Kalk's method) : (see table 31)

Gastric juice of 9 convalescent patients was examined at the 7th week. The acidity of fasting juice was decreased in half the cases (5/9); some showed anacidity. But the acidity after the test material was normal or above. It took the longer time than usual to reach the maximum acidity, for example 90-100 minutes. In general gastric juice contained much mucin.

Occult blood was present in 50%.

Lactic acid was present in 80%.

Lieutenant Shiozu of Okayama Hospital also reported that anacidity or hypacidity of the gastric juice had been found in the 2nd stage.

8. Cerebrospinal fluid:

As shown in table 29, no change were found.

Table 29

Name	date	pressure (beginning and after taken 3cc)	turbidity	colour	Pandy	Nonne	cell count
Tanimoto	23/IX	275-150	-	-	-	+	
Matsuda	24/IX	180- 90	-	-	±	±	7/3
Motoi	"	60- 40	-	-	++	+	21/3
Sakuma	"	215-130	-	-	±	+	3/3
Okita	"	90- 50	-	-	±	+	4/3



V Case reports

Laboratory data of patients in 2nd & 3rd stage who were observed in Ujina Hospital, are as shown in table 30 & 31.

Following cases were typical & their disease-histories were indicated on fig. 10 .

List of the case-reports

- 1) S. Uchida soldier 41 y. old (from Fukuyama Hospital)

Dead case in the 1st stage with the complaint of high fever & diarrhea.

- 2) B. Minemasa soldier 21 y. old (from Eba Hospital)

Dead case in early 2nd stage with the complaint of fever, diarrhea, depilation & hemorrhage.

- 3) K. Matsumoto soldier 34 y. old (from Eba Hospital)

Dead case in 2nd stage with the complaint of fever, depilation & hemorrhage.

- 4) K. Satoi soldier 22 y. old (Ujina Hospital our own case)

Dead case in 2nd stage with high fever, depilation & hemorrhage.

- 5) T. Matsumoto soldier 21 y. old (Ujina Hospital our own case)

Dead case in 2nd stage with extreme high fever, depilation & hemorrhage.

- 6) S. Morita clerk female 21 y. old (Ujina H. our own case)

Dead case in 2nd stage. Main symptoms were continued high fever, depilation & hemorrhage.

- 7) T. Moriseko soldier 33 y. old (Ujina H. our own case)

Dead case in 2nd stage. Extreme high fever, depilation & hemorrhage especially hematuria.

- 8) K. Ishida officer 25 y. old (Ujina H. our own case)

He died in 2nd stage with continued high fever, depilation & hemorrhage.

- 9) H. Yoshida officer 35 y. old (from 2nd Army Hospital)

Survived case with the complaint of fever, hemorrhage especially rectal bleeding.

- 10) H. Okita soldier ? (Ujina Hospital our own case)

Survived case with the complaint of fever, depilation & hemorrhage.

- 11) S. Okuda soldier ? (Ujina Hospital our own case)

Survived case with the complaint of depilation & hemorrhage.

Fig. 10--1

No. 1. S.Uchida: soldier 41 y. Chugoku 32059 Garrison (Fukuyama H.)

Location: Kakomachi (north side of Prefecture building)

0.6 Km from the center, outdoor.

Burn & injuries: 2nd degree burn on the left side of face and a
contusion of the left chest.

Course of symptoms:

Soon after developed severe watery diarrhea daily 30 times
or more. Evacuated to Fukuyama Hospital on 11/VIII. On the
same day body temperature rose suddenly to 40°C, and visual
disturbance appeared.

On 13/VIII nausea & vomiting appeared.

He died on 15/VIII.

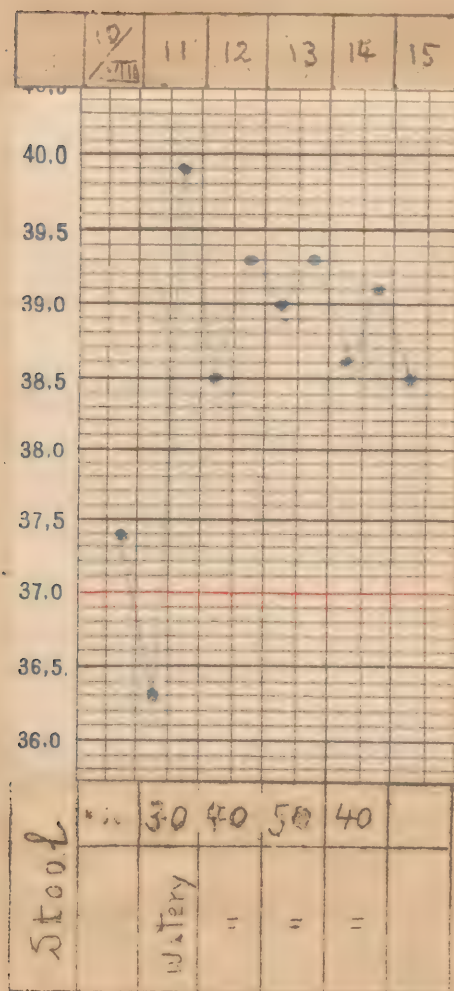




Fig. 10--2

No. 2. F.Minemasa soldier 21y. Chugoku III Garrison (Eba Hospital)

Location: 111 Garrison 0.5 Km north from the center.

Inside of a wooden building. /

Burn & injury: Contusion on head and small of back

Cause of symptoms:

Soon after developed watery diarrhea . He was sent to the Eba Hospital on 11/VIII. On 15/VIII body temperature rose to 38.7 C and then showed strong remission successively until death. On 19/VIII depilation of scalp and petechia appeared. On 22/VIII he had sore throat. On 24/VIII epistaxis began and he died on the same day.

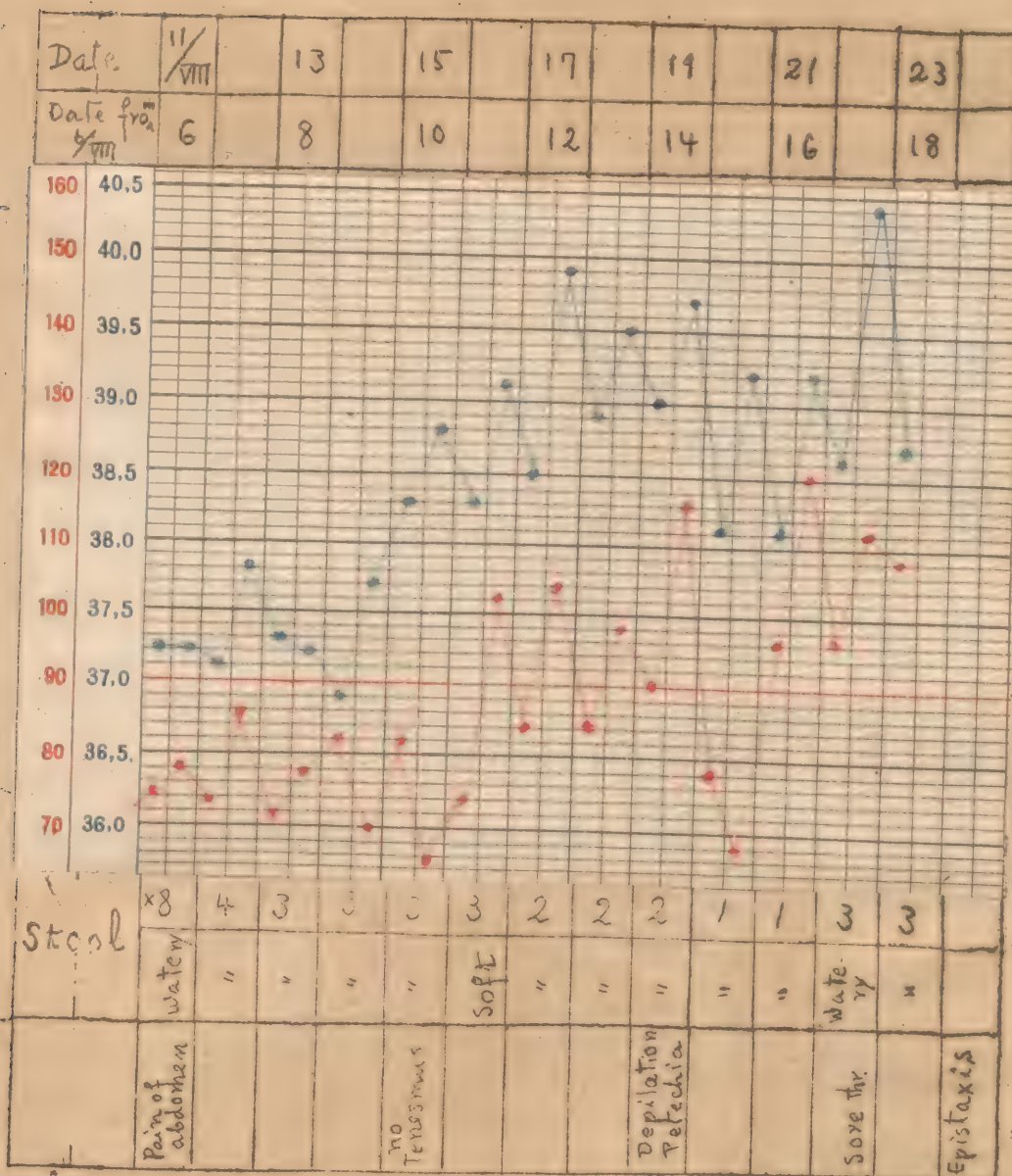


Fig. 10--3

No. 3. K. Matsumoto soldier 34 y. Chugoku 111 Garrison (Eba Hospital)

Location: 111 Garrison 0.5 Km north from the center

Indoor of a wooden building

Burn & injury: Contusion on the small of back

Course of symptoms:

Soon after the explosion manifested diarrhea. He was admitted on 11/VIII to the Eba Hospital. On 15/VIII contracted colon was palpable in the left lower quadrant of abdomen but no pain by pressure. On 19/VIII appeared hyperemia of pharynx and both submandibular lymph glands swelled painfully. On 20/VIII gingiva bled. On 21/VIII gingiva swelled violetly. On 22/VIII depilation of scalp hair and petechia were noted. From 23/VIII oral bleeding continued until death. On 24/VIII he died.

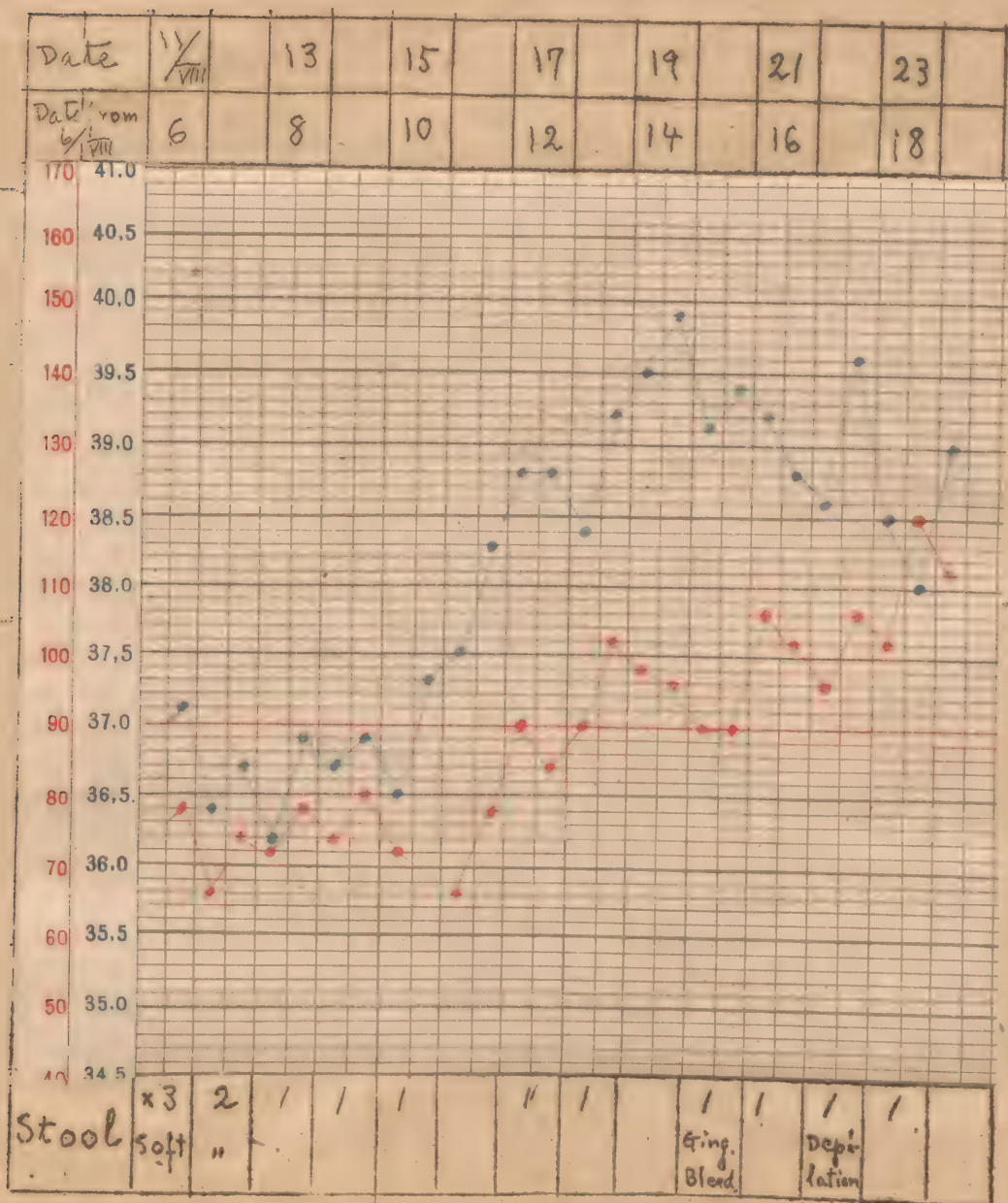


Fig. 10--4

No. 4. K.Sato soldier 22 y. Akatsuki 16170 Garrison (Ujina Hospital)

Location: Kakomachi (near Prefecture building) 0.8 Km southwest from the center. He was on the bank of River Temma & thrown into the river by blast.

Burn & injury: Contusion on head & small of back which healt not later than 20/VIII. Afterwards he worked usually.

Course of symptom:

He noted depilation of scalp hair between 20/VIII--25/VIII.

On 25/VIII rose the body temperature, and petechia manifested.

On 28/VIII he was admitted to the Ujina Hospital. At that time conjunctiva & other visible mucous membranes were anemic, and hemorrhagic stomatits, gingivitis & tonsillitis were notable. Scalp hair was totally and beard partially depilated but eyebrows remained intact. Petechias was on the whole body especially much quantity on scalp skin. On 24/VIII petechia increased and visual disturbance appeared.

On 30/VIII disturbance of consciousness.

On 31/VIII 9 a.m. he died.

Laboratory datas

Date	r.b.c.	Hb (%)	w.b.c.	bleedingtime	blood pressure
28/VIII	2.11	45	333	28'	96-----58
31/VIII	2.30		45		



Petechia
(28/VIII)

Date	28/VIII	29	30	31
Date from b/VIII	23	24	25	26
Stool	x8	10	13	
	watery		bloody	
Laboratory data	T.w.b.c. 333 r. = 2.11 Hb 45% Bleeding time 28' B. press. 96-58			T.w.b.c. 45 r. & c. 2.3

Fig. 10--5

No. 5. T. Hashimoto soldier 21 y. Chugoku 104 Garrison (Ujina Hospital)

Location: 104 Garrison 1.0 Km north-east from the center.

Indoor of a wooden building.

Burn & injury: Laceration on the back, the right side of abdomen & the right elbow. He worked as usual.

Course of symptoms:

He noted depilation of scalp hair on 18/VIII, gingival bleeding and petechia on 29/VIII and was evacuated on 30/VIII to the Ujina Hospital. At that time laceration at the right side of abdomen & the right elbow were not yet healed. Many petechias spread over the whole body surface. Half of the scalp hair was depilated. Gingiva & soft palate swelled dark red. Small ulcers were noted here and there in oral mucous membrane. Submandibular lymph glands swelled painfully. From the 31/VIII night body temperature rose. On 1/IX sore throat & pain on swallow. The tonsillæ was coated with yellowish grey pseudomembrane. Gingival bleeding appeared. Petechias increased on the face, both arms and forearms. On 2/IX disturbance of consciousness, delirium appeared. On 3/IX 9.30 p.m. he died.

Laboratory data

3/IX r.b.c. 2.08 Hb 40% w.b.c. 1900 platlet 10400 bleeding t. 46"



Petechia (3/IX)

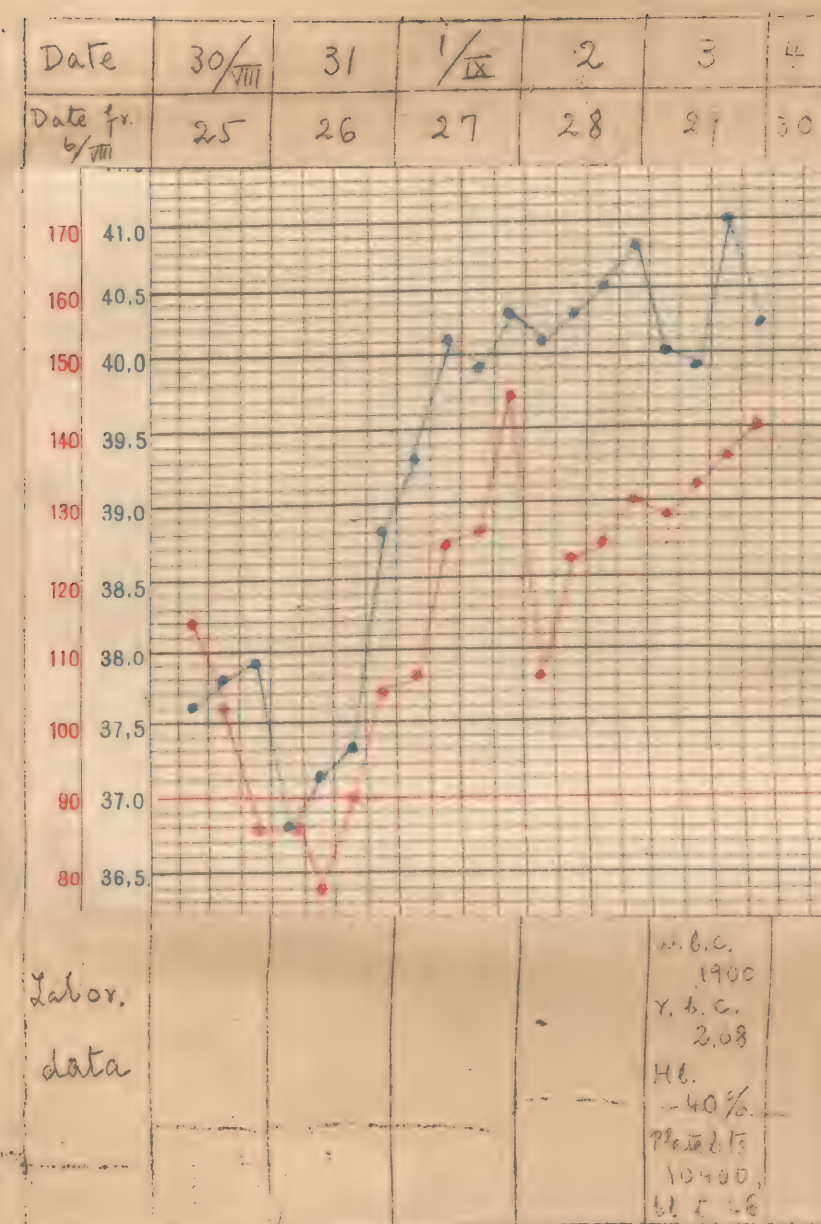


Fig. 10--6

No. 6. S. Morita clerk of army 21 y. female (Ujina Hospital)

Location: At her home (near city hall) 1.0 Km south east from the center
Indoor of a wooden house.

Burn & injury: no

Course of symptoms:

She noted depilation of scalp hair on 18/VIII & petechia on 23/VIII. She was admitted to the Ujina Hospital on 27/VIII. She looked slightly anemic. She had both swelled tonsils & sore throat. Petechias were on the whole body surface sporadically. Scalp hair depilated easily. On 2/IX appeared bloody stool. Incontinence appeared from the evening. On 3/IX she became unconscious and died.

Laboratory data

28/VIII r.b.c. 2.3 Hb 45 % w.b.c. 230 coagulation time 18'
sedimentation rate 134/60'

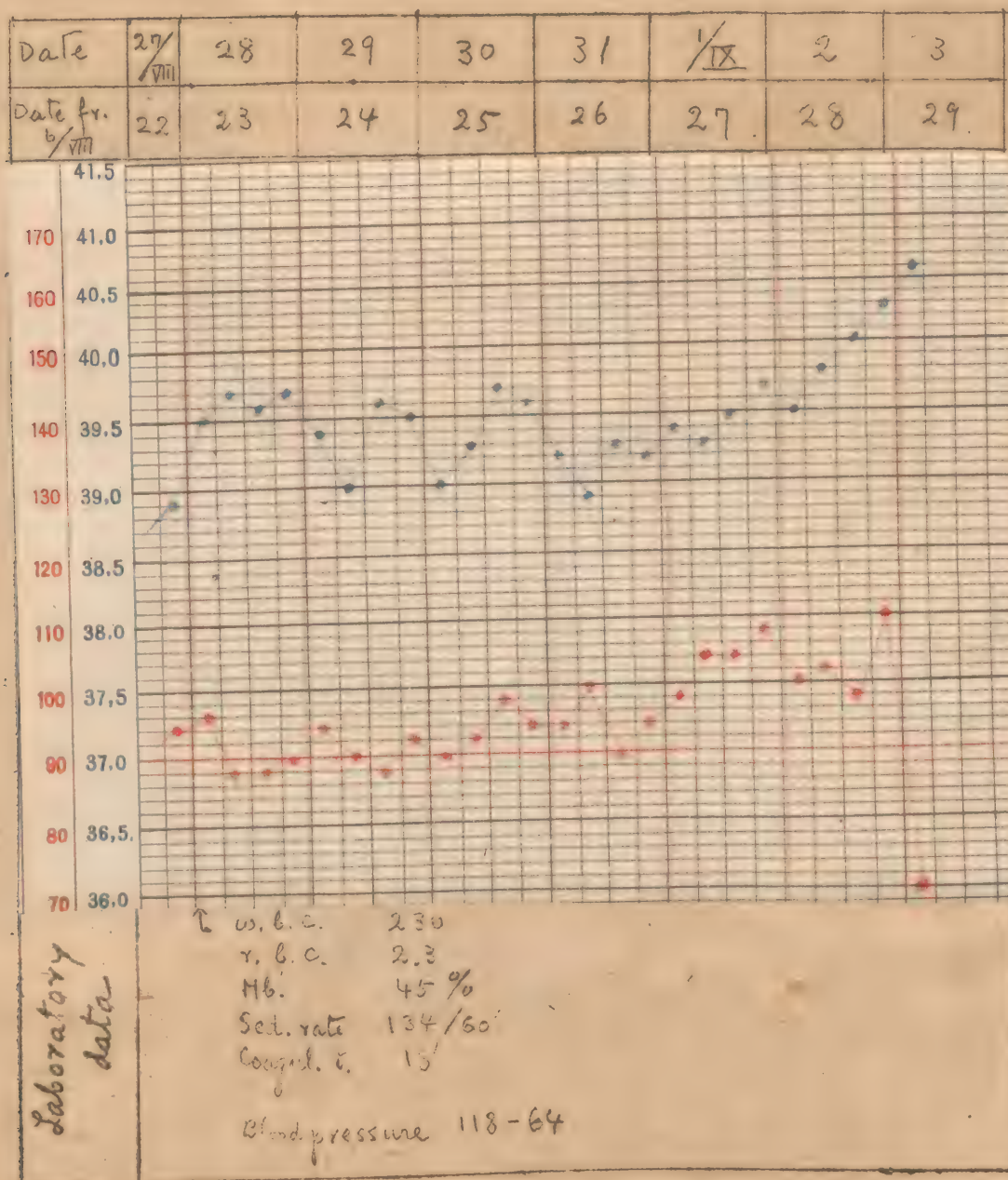


Fig. 10--7

No. 7. T. Moriseko soldier 33 y. Chugoku 104 Garrison (Ujina Hospital)

Location: 104 Garrison 1.0 Km north-east from the center

Outdoor

Burn & injury: Laceration ~~at~~^{of} on the small back which healed on 18/VIII

Source of symptoms:

On the very day of bombing appeared vomiting. He felt rise of bodytemperature during 6/VIII--8/VIII. He noted depilation on 20/VIII, petechia & rise of temperature on 27/VIII, & admitted ^{was} to the Ujina Hospital on 28/VIII. At that time he looked anemic. The scalp hair & beard depilated almost completely.

Symptoms of stomatitis & tonsillitis were notable. Small ulcer was found in the right edge of the tongue. Petechias spread on the whole bodysurface, especially much in quantity on the the chest & arms.

On 29/VIII the ulcer of the tongue enlarged & it was painful. Hematurine appeared from this morning. On 30/VIII petechia increased. Bacillus in blood was examined on this day & the result showed positive streptococcus hemolyticus.

On 6/IX he died.

Laboratory datas

Date	r.b.c.	Hb (%)	w.b.c.	Coagulationtime	resistance of r.b.c.
29/VIII	2.27	60	1100		
2/IX				11'30"--23'30"	
3/IX	2.09	50	900		
5/IX	1.58	35	200		
6/IX					0.38--0.42 %



Petechia & Stomatitis
(3/IX)

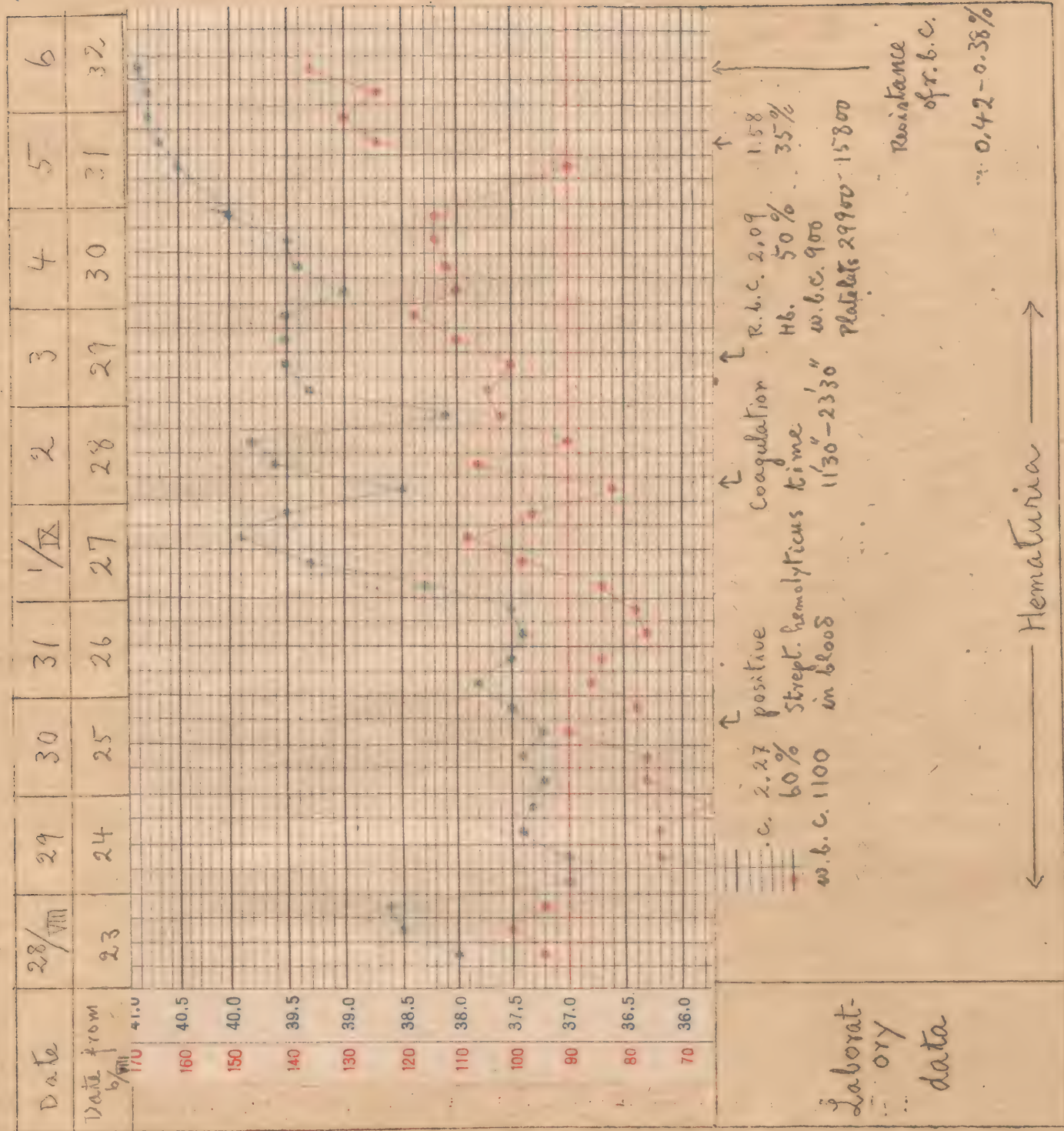


Fig. 10--8

No. 8. K.Ishida officer 25 y. (Ujina Hospital)

Location: Chugoku H.Q. 140 Km north from the center
Indoor of a wooden building

Burn & injury: no

Course of symptoms:

On the very day of bombing appeared vomiting. He felt sore throat on 21/VIII, noted depilation on 23/VIII and petechia on 27/VIII & was admitted to the Ujina Hospital on 27/VIII. The tongue was coated brownly & had tendency of bleeding. Both tonsil were swelled. Scalp hair were sparsely. Small petechias were generalized on the whole body surface. On 29/VIII appeared bloody stool & epistaxis, which was difficult to stop. On 1/IX appeared disturbance on consciousness. He died on 2/IX.

Laboratory dates

Date	r.b.c.	Hb (%)	w.b.c.	bleeding time
28/VIII	2.4	50	300	32'
31/VIII	1.0	35	300	45'

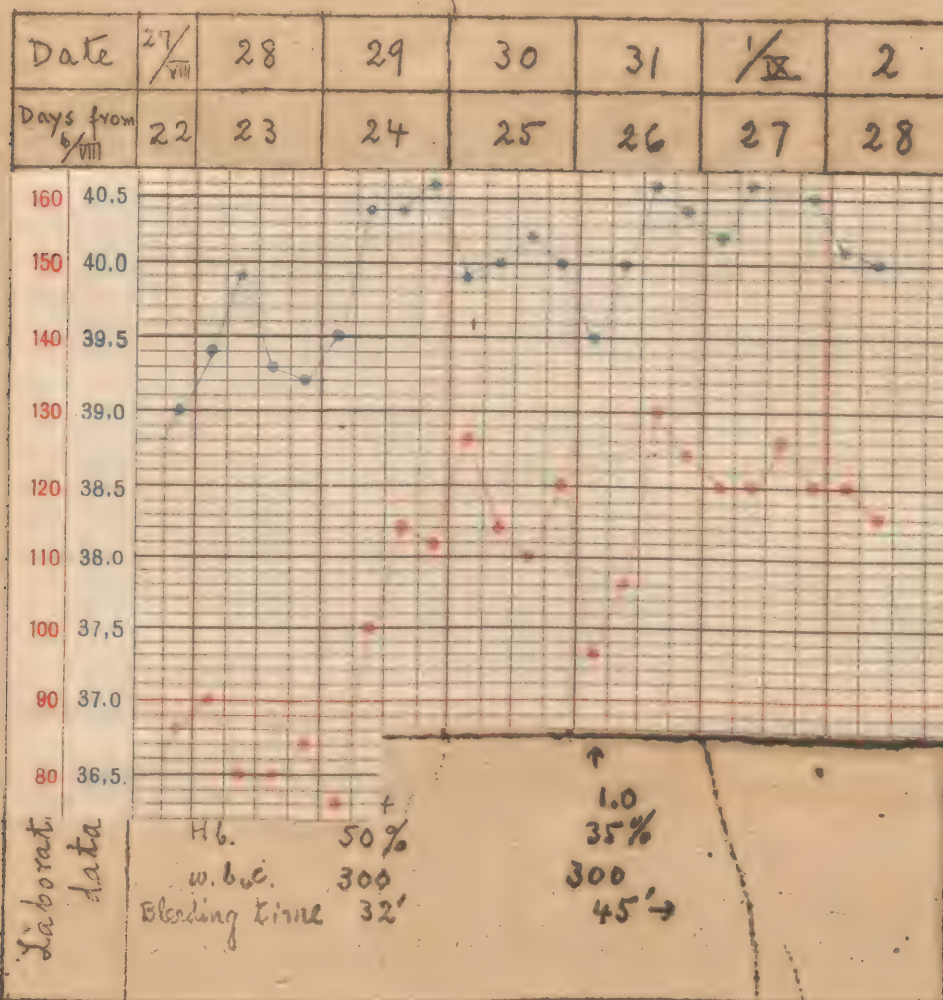


Fig. 10--9

No. 9. H.Yoshida officer 35 y. 2nd Army Hospital (2nd Army Hospital)

Locationä 2nd Army Hospital 1.0 Km north from the center
Indoor of wooden building

Burn & injury: no

Course of symptoms:

Vomiting appeared after the bombing on 6/VIII. Anorexia continued from 6/VIII until 13/VIII.

He noted petechia and gingivableeding on 28/VIII.

On 5/IX began bloody stool. He noted two big petechias on the abdomen and also yellow color of the skin which varnished after three days. Before 15/IX all petechias varnished.

Laboratory datas

	28/VIII	4/IX	11/IX	22/IX	11/X
w.b.c.	1800	1800	1000	3600	6800

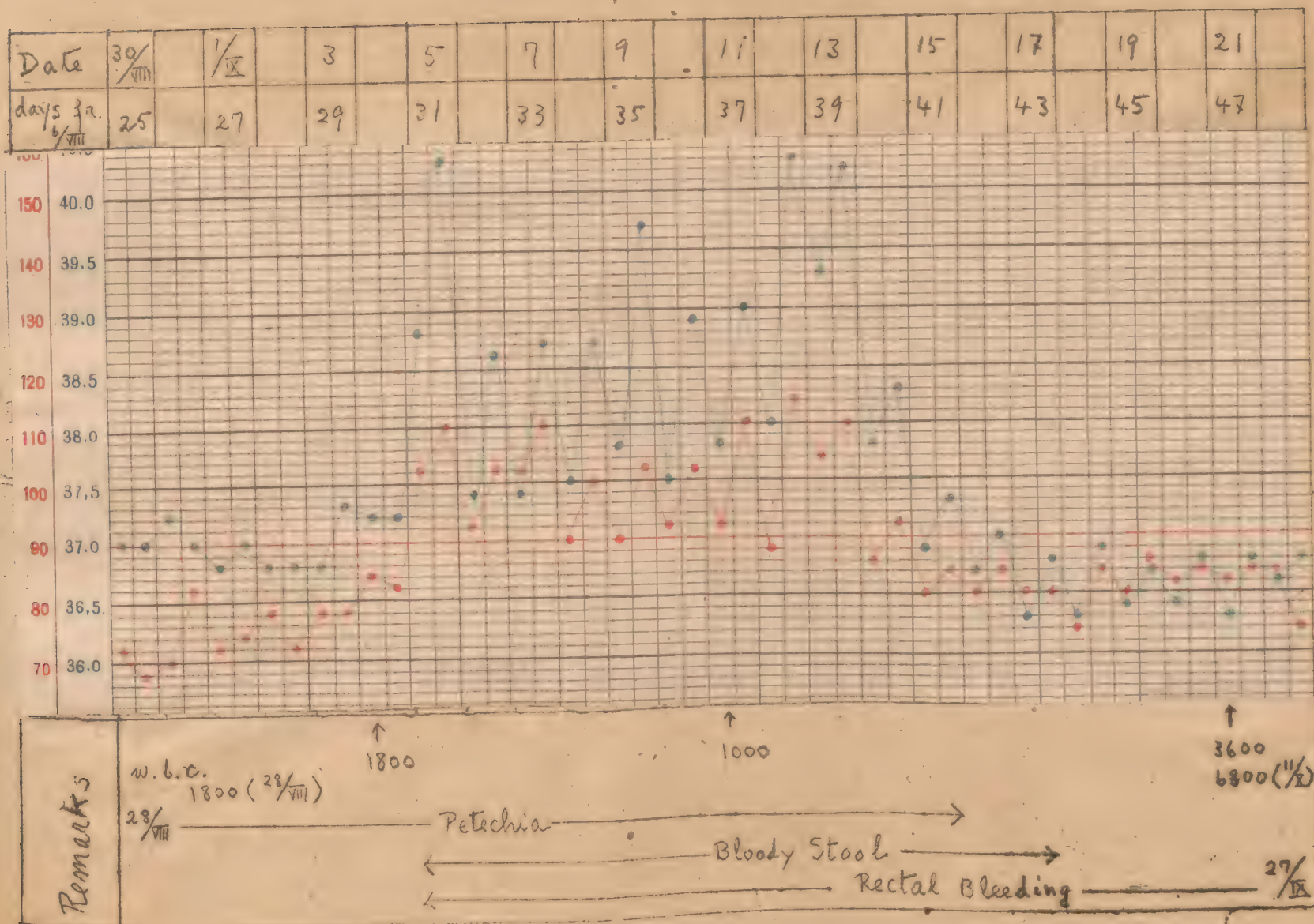


Fig. 10--10

No. 10. H. Okita soldier Chugoku 104 Garrison (Ujina Hospital)

Location: 104 Garrison 1.0 Km north-east from the center

Indoor of a wooden building

Burn & injury: Laceration on right arm by glass splinter & contusion
on right shoulder

Course of symptoms:

On 20/VIII he noted depilation & on 27/VIII he felt rise of body temperature and was admitted to the Ujina Hospital on 30/VIII. At that time he felt malaise & headache, and looked anemic. Scalp hair stopped depilation but very thin. No petechia was noted. On 30/VIII gingiva swelled red & painfully and only one petechia on oral mucous membrane & several petechias on the skin of both forearms were noted. On 4/IX petechias increased no more but pain of gingiva became violently. On 11/IX gingival bleeding appeared. On 4/X he left the Hospital.

Laboratory datas

Date	r.b.c.	Hb (%)	w.b.c.	platlet	coagulation time
30/VIII			1300		
2/IX					6'30"----9'
4/IX	2.6	68	1400	5200	
19/IX	2.6	52	2800		
24/IX	2.8	51	4600		4'15"----8'15"
Resistance of r.b.c. -----19/IX 0.36--0.42 %					
Resistance of capillary -----10/IX 1-100 , r-80 mm Hg					
Sedimentation rate-----4/IX 108 / 60' 24/IX 32 / 60'					

Differential count of w.b.c.

	19/IX	24/IX
Myelocyte	0.5	
Metamyelocyte	1.5	
Band-form	21	3.5
Segm. form	26	69.5
Eosinophile	1.0	0
Monocyte	1.5	9.5
big Lymph.	10.5	3.0
small Lym.	22.5	14.5
Plasmacell	6.0	0

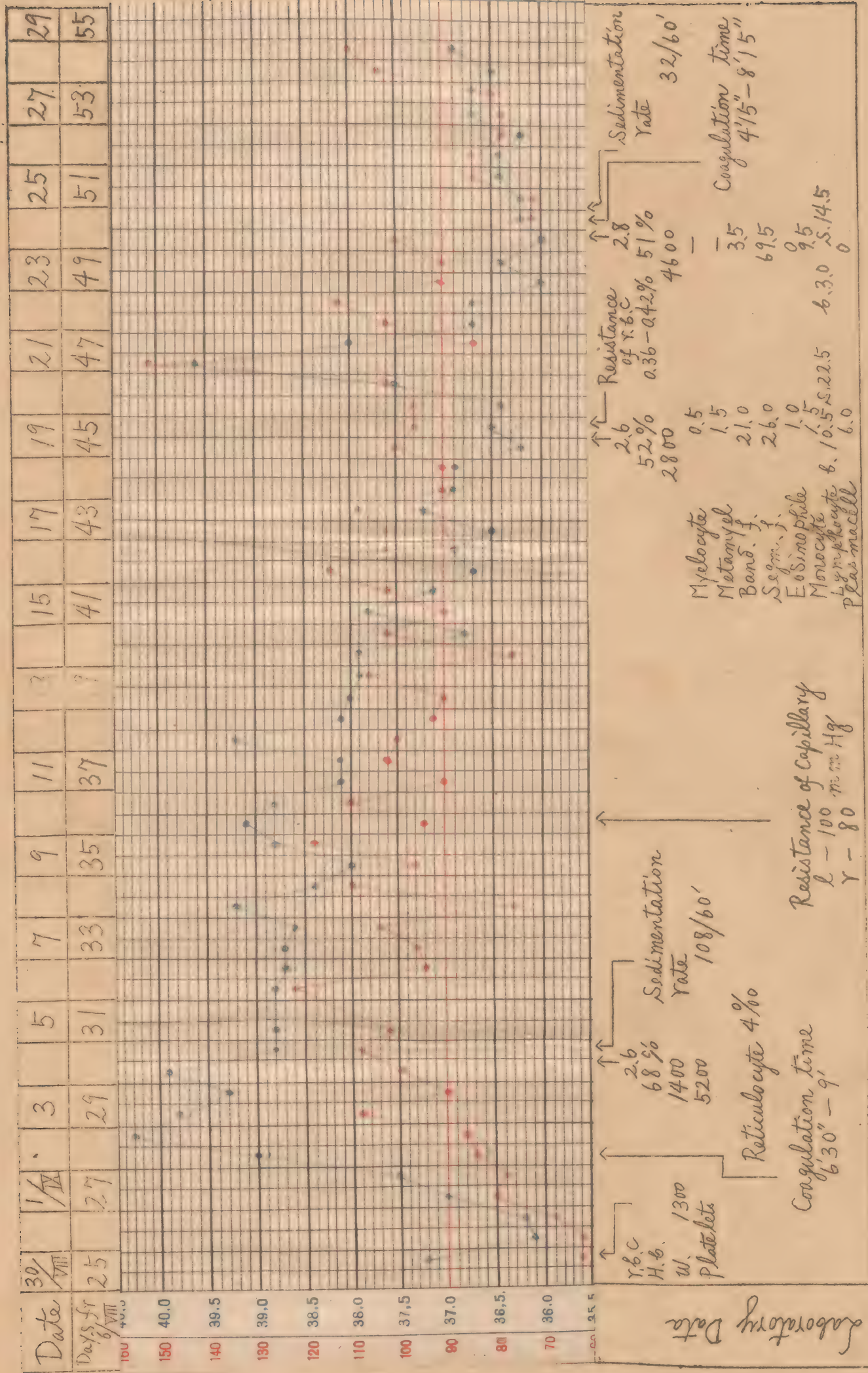


Fig. 10--11

No. 11. S. Okada soldier

Chugoku 104 Garrison (Ujina Hospital)

Location: 104 Garrison 1 Km north-east from the center

Indoor, he was in the corridor of the down stairs of a two-story house

Burn & injury: Laceration on the small of back.

He worked as usual.

Course of symptoms:

Depilation began from 20/VIII & it stopped on 26/VIII. He was admitted with symptoms of headache & sore throat to the Ujina Hospital on 29/VIII. Reddening of the pharynx was not high degree. No petechia, no anemia was noted. On 31/VIII appeared three petechias on the left forearm. He felt pain on gingiva on the same day. Sore throat became violently on the 1/IX. On 5/IX remarkable gingival bleeding appeared but the petechias vanished on this day. Before 23/IX disappeared gingiva pain & sore throat.

He left the Hospital on 29/IX.

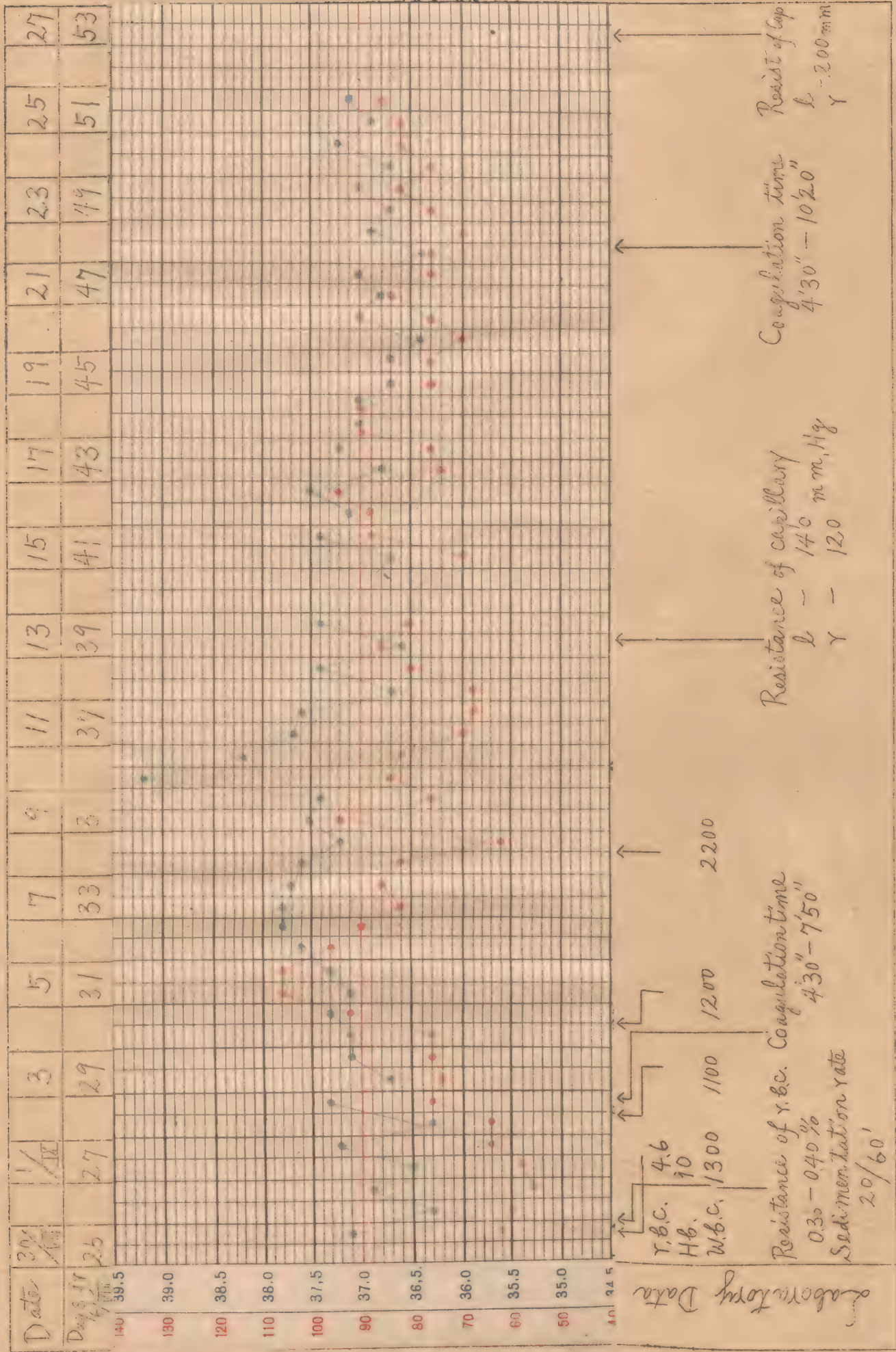
Laboratory data

Date	r.b.c.	Hb (%)	w.b.c.	Sedimentation rate	Coagulation time
30/VIII	4.6	90	1300	20 / 60'	
2 /IX			1100		4'30"--7'50"
4 /IX			1200		
8 /IX			2200		
22/IX					4'30"--10'20"

Resistance of r.b.c. ----- 30/VIII 0.36--0.40 %

Resistance of capillary ----- 13/IX 1 -140 r -120 mm Hg

27/IX 1.r -200mmHg



RADIATION DISEASE (Part 2)

I. Effect upon appendages of the skin.

The effect of neutron and γ -ray upon the hair, the sebaceous gland and sweat gland as accessory organs of skin was investigated mainly at the end of September in 243 cases, consisting of 194 in-patients in Ujina Branch Hospital, 110 outpatients and 29 patients, who were treated at various first aid station in and near Hiroshima city.

1. Depilation

1) Causative agencies of depilation.

a. Range of depilatory effect.

It lay within 1.5km radius from the centre of bombing. (fig. 11)

b. Relation between the patient's state and the depilation.

The finding in 243 patients who manifested the typical symptoms of radiation disease as shown in table 32

Table 32.	depilated	non depilated	total
survived	106 (81.1%)	25 (18.9%)	131
dead	86 (80.9%)	20 (19.1%)	106

The severity of disease was not always parallel to the depilation.

c. Relation between sex and depilation.

The result of the investigation in those patients above mentioned was as follows:

Table 33.

sex	depilated	undepilated	total
male	153 (79.6%)	39 (20.4%)	192
female	129 (86.6%)	20 (13.3%)	149

No remarkable difference was found.

d. Relation between the degree of the depilation and the distance from the centre.

Relation between the degree of the depilation and the distance from the centre was investigated for 106 patients, who manifested the symptoms of radiation disease. The results were as in table 34.



Fig 11. Range of Depilatory Effect



Note : 1. \circ depilated Patient
 2. \square non-depilated Patient
 3. Number in \circ & \square means the number of patients

Table 34.

Degree of depilation	Distance from the centre						total
	0-0.5	0.5-0.7	0.7-0.9	0.9-1.1	1.1-1.3	1.3-	
severe	1	1	7	17	7	1	34
moderate	1	2	2	11	4		20
mild	1	1	4	18	6	2	32
undepilated	1		2	10	7		20
total	4	4	15	56	24	38	106

note: The results were based on survivors at the end of September.

e. Relation between shelter and depilation.

The results obtained from 99 patients whose location¹⁰ at the time of explosion was known, were as follows:

Table 35.

	depilated	undepilated	total
in doors	58 (73%)	21 (27%)	79 (80%)
out doors	18 (90%)	2 (10%)	20 (20%)
total	76	23	

note: 11 12 patients of those who were outdoor had burns and 2 of them were not depilated.

2 The result was obtained from the survivors at the end of September.

As the cases were small in the number, we could not draw decisive conclusions for the protective power of the shelter. However, considering the absorbing ability of buildings for neutron and γ -ray, the depilation of those who were in the concrete building might be milder than the depilation of those who were out of door, at the same time distance. There was one example: a man (named Takahashi 24y.), who was in the basement of Fukoku building (0.3 km southeast from the centre , 7 story concrete building), felt the blast but manifested no typical symptoms.

f. Relation between age and depilation.

The result obtained from 112 radiation disease patients showed no remarkable relation between age and depilation.

Table 36.

Table 36.

Degree of depilation	age					
	-10	10-20-	20-30	30-40	40-50	50-
severe	1	3	19	11	2	2
moderate			12	4	4	
mild	1	1	16	7	4	
undepilated		3	12	5	1	4
total	2	7	59	27	11	6

In short, since the cause of depilation may be the direct effect of neutron and γ -ray upon the hairfollicle, the grade of depilation must be sever for those, who were near to the centre. Depilation of those, who were at the same distance differed according to the existence of various shelters and personal constitution.

2) Course of depilation

a. Appearance of the depilation

48 patients (29%) among 164, consisting of 69 dead in the 2nd stage and 95 survivors in Ujina Branch Hospital, first noted depilation on 20/VIII. The depilation of 141 cases (86%) within the 2nd and 3d week.

i) Difference in depilation between the survivors and dead

The date when the depilation appeared was not notably different in the survivors, who had mild symptoms and the dead, who had severe symptoms and succumbed in the 2nd stage, as shown in fig.12.

ii) Relation between the degree of the depilation and its appearance date.

This was investigated for 37 severe cases of depilation and 47 moderate or mild cases of depilation. The milder cases tended to begin somewhat later. (see fig. 13)

iii) Relation between sex and appearance date of depilation.

The result of investigation in 129 male and 35 female patients indicated no notable difference between sex and the appearance of depilation as shown in fig. 14.

Fig 12 Appearance of depilation concerning survivors and deads

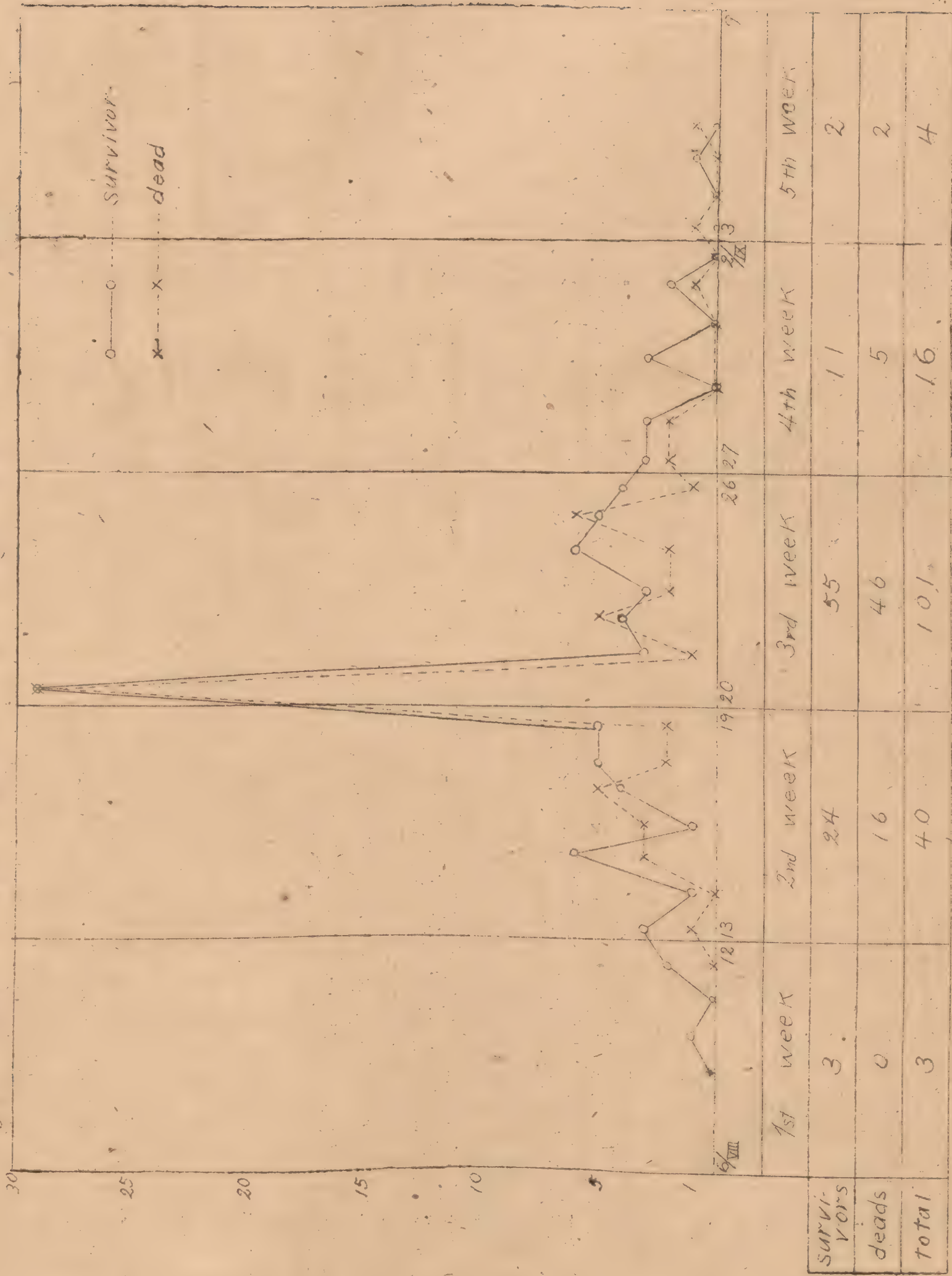


Fig. 13 Relation between degree of the depilation and its appearance date

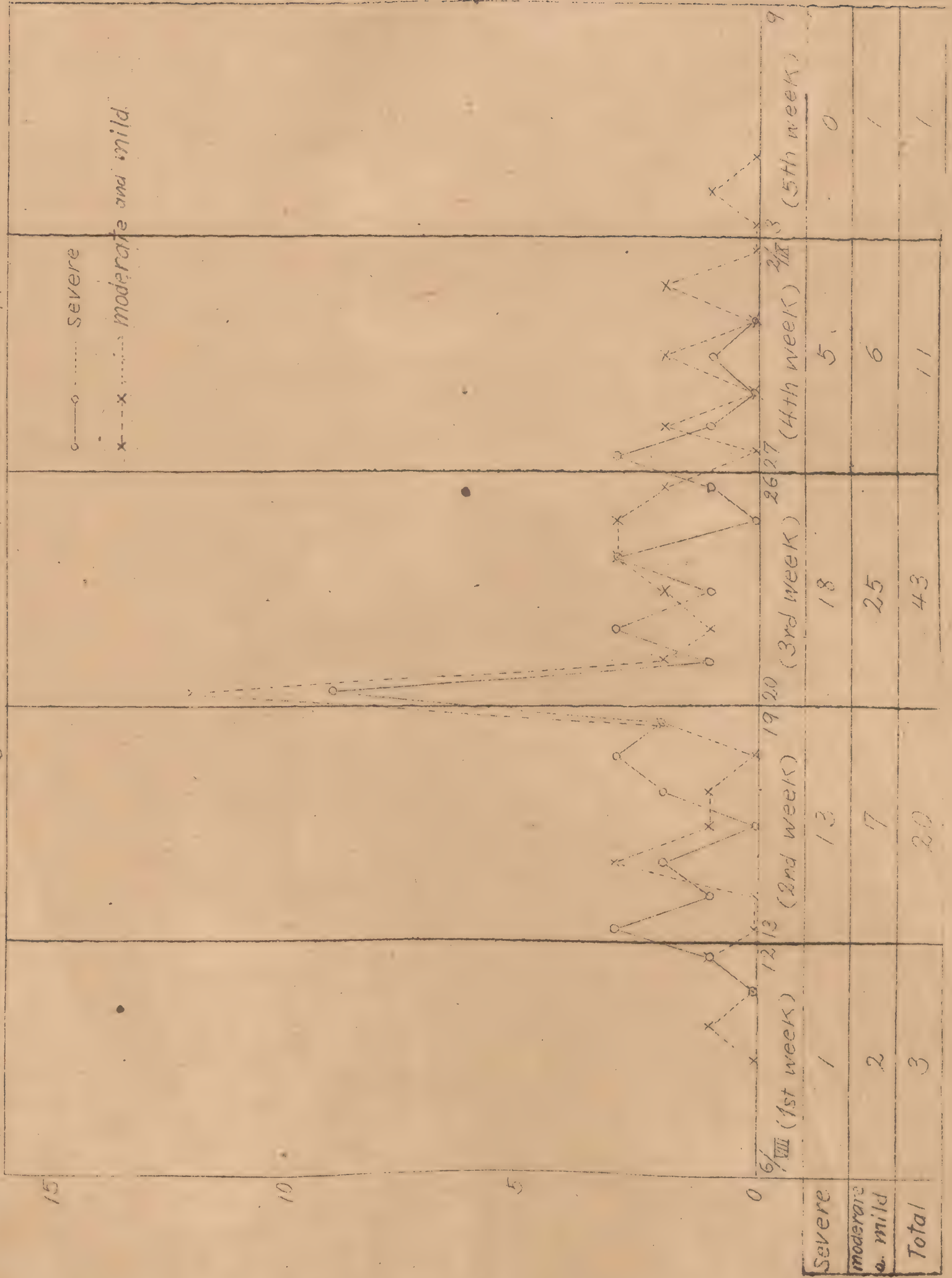
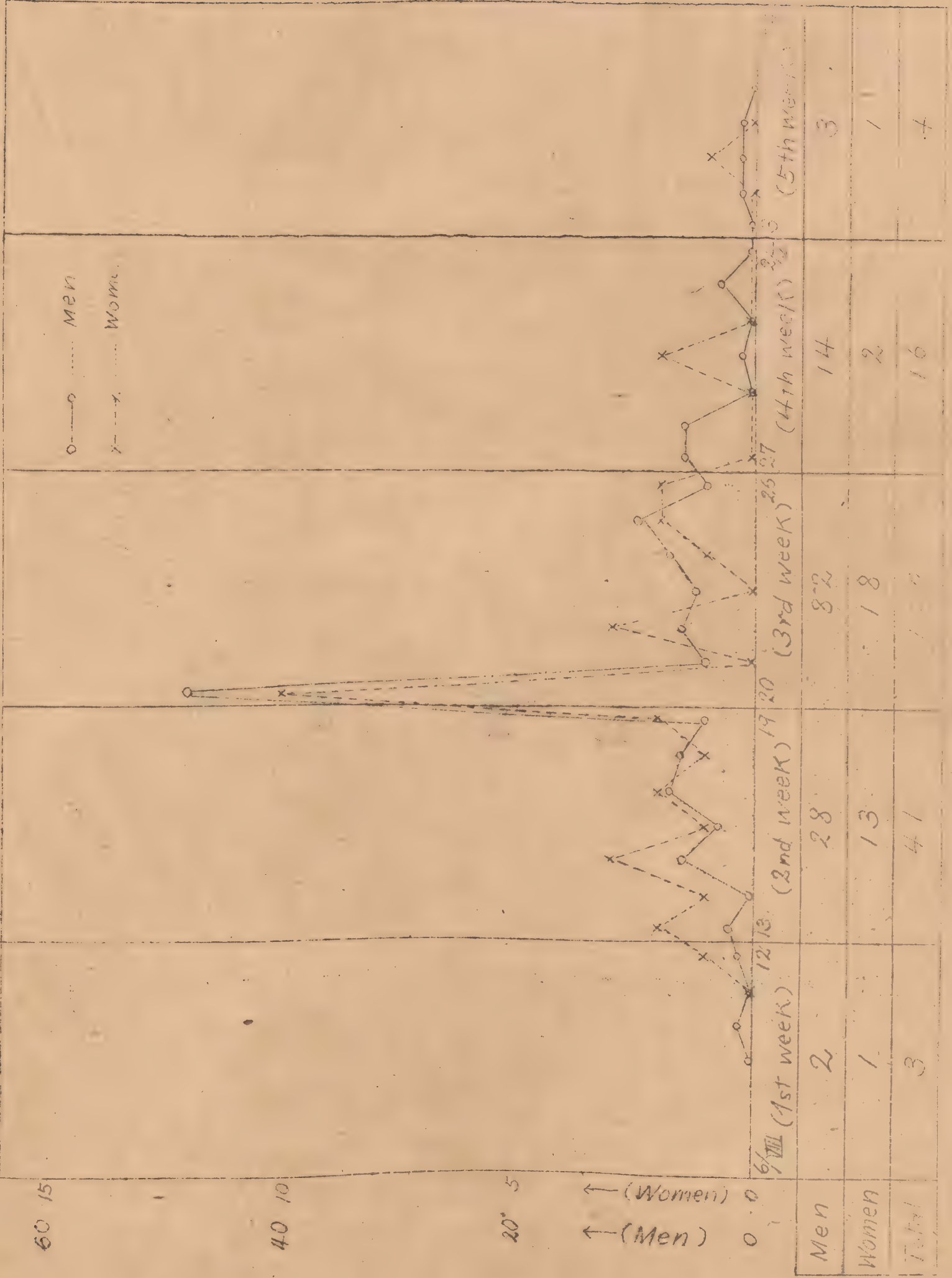


Fig. 14 Relation between sex and appearance date of depilation



b. Localisation of depilation

The result of investigation in 91 survivors was as follows:

i) Localisation of depilation

Depilation of the scalp was seen in all cases, and depilation of the other parts was found only in 8 cases (8%). Detail of depilation of these 8 cases were as shown in table 37.

There were found depilation of face hair in 6 cases among 8, pubes in 3 cases, eyebrow in 2, axillary hair in 1, chest hair in 1, and lanugo hair^m 1. The degree of eyebrow depilation was mild in all cases. In the case of lanugo depilation, the depilation of the body hair was observed one week after the exposure, but the lanugo hair began to regenerate earlier than the other hair. There was no case of depilation of the eyelashes. The difference of depilation according to the localisation of hair seems to due to the difference of the depilation dosage of hair by neutron and γ -ray.

ii) Localisation of depilation of scalp hair

Result obtained from 81 depilation cases of scalp hair was as following:

whole	head	38
mainly	fore head and parietal part	20
mainly	fore head, parietal and temporal part	10
mainly	fore head	4
mainly	parietal part	1
mainly	temporal part and parietal of head	1
mainly	fore head back head and parietal part	1

In many relatively severe cases the hair border, especially the neck and side-locks remained without depilation. This fact paralleled to the strength of adhesive power of hair.

iii) Unilateral depilation

6 cases showed predominant depilation of one side as shown in table 38.

The unilateral depilation was observed mainly in those, who were inside of concrete buildings. We have no material to explain this fact.

Table 37 Degree of depilation

Name	age ⁺ sex	Scalp hair	beard	mustache	Whiskers	eyebrow	Chest hair	axillary hair	pubes trugo	remarks
Shimohara	26 ♂	severe	mild							1.0 km. no burn no injury
Yamomuka	30 *	severe	moderate	moderate					moderate	0.8 km. no burn laceration back of head, right cheek severely depilated left side of head
Morimoto	26 ♂	severe	moderate	moderate						1.0 km. no burn no injury
Iwanaga	31 ♂	severe	moderate							1.3 km. no burn no injury
Matsumura	31 ♀	severe							mild	1.3 km. no burn no injury
Kawasaki	42 ♀	moderate	moderate	moderate						0.3 km. no burn laceration right arm severely depilated right side
Kawabuchi	47 ♀	severe	l. mild r. severe	r. mild	r. severe	r. mild	r. moderate			0.3 km. no burn laceration r. head & r. cheek
Obata	40 ♀	severe				mild		severe	moderate	1.2 km. no burn no injury
Total		8	6	4	2	2	1	1	3	1

Table 33

Name	Age and sex	Depilation	Distance	remarks
Kawabuchi	47	r. scalp hair depilated earlier than l. side. Depilation of r. beard and r. eyebrow.	0.3km	In 4/7 story concrete building behind a pole received the blast on right side of body
Kawasaki	42	severe on r. side of scalp hair and beard	0.3	In 3/7 story building sustained of r. arm.
Yoshikawa	50	severe on l. side of scalp hair	0.4	In 2/3 story concrete building received the blast on l. side of body.
Yamanaka	30	severe on l. side of scalp hair and beard	1.0	Laceration at r. cheek
Takeuchi	70	severe on r. side of scalp hair	1.2	At entrance of concrete building. Burn r. arm and forearm.
Yoneda	45	severe on l. side	1.2	Crushed under a house.

c. State and degree of depilation

The depilation began suddenly at a certain periods and occurred easily bunch as result of rubbing with pillow or hand as well as by plucking with fingers. The depilation began at first on the parietal region or forehead and then spread to the whole scalp. At the period of maximum depilation the depilated hair seemed to have no hair follicle and looked like a cut hair, but in the convalescent stage they again showed hair follicles. Depilation also decreased gradually.

Several stage of depilation were seen, which were:

1. severe-----almost perfect baldness but a few hair remained
2. moderate---- nearly half of hair depilated
3. mild-----slightly reduced

But there was no case, which was perfectly depilated as in alopecia areata. In general the white hair in youth never depilated. The degree of depilation investigated in 117 patients, consisting of 89 survivors and 28 dead was as shown in table 39.

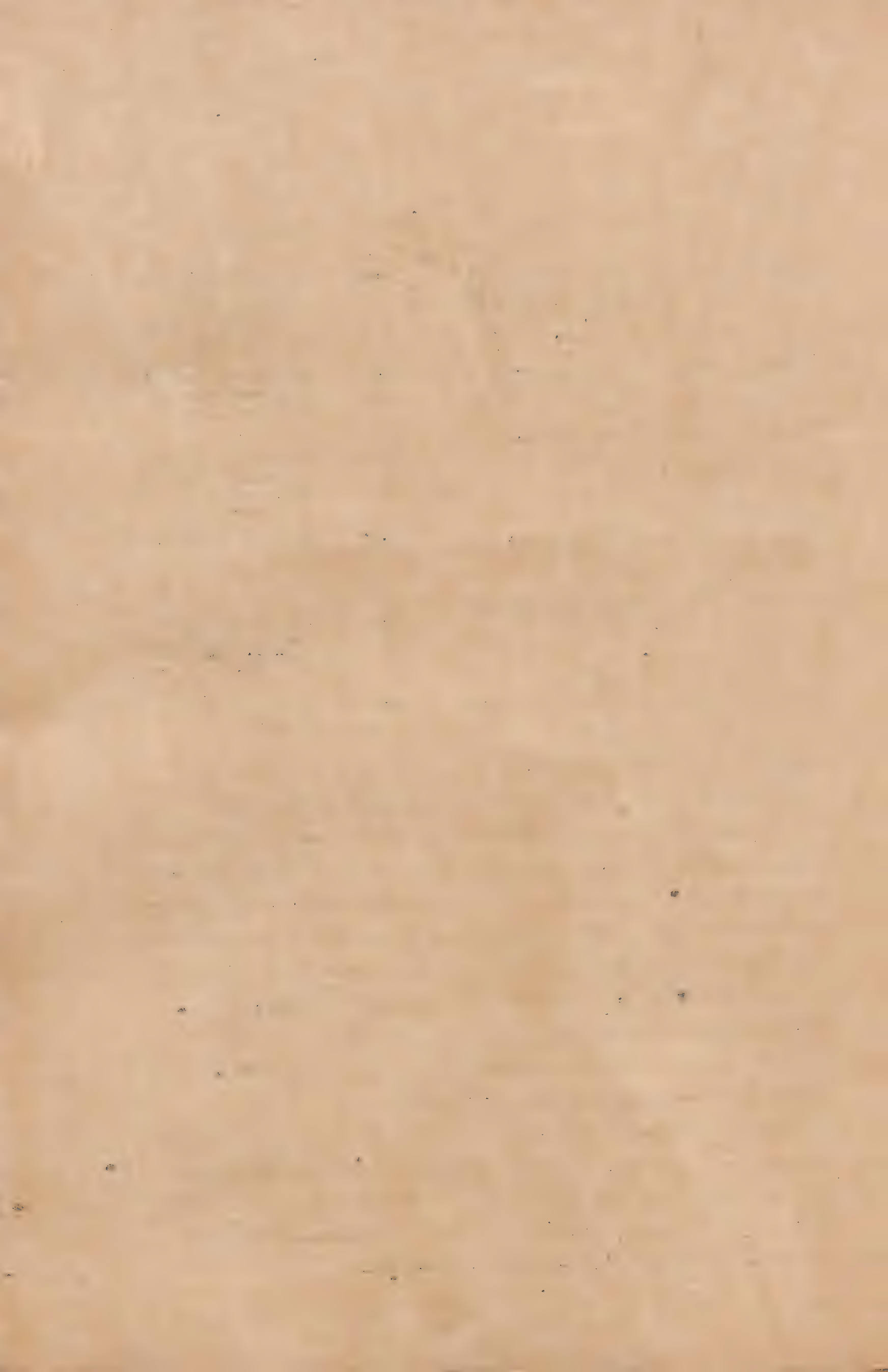


Table 39.

Degree of depilation	survivors	dead
severe	38 (42.6%)	12 (42.8%)
moderate	20 (22.4%)	6 (21.4%)
mild	31 (34.8%)	10 (38.8%)

There was no difference ~~of~~ in grade of depilation among the survivors and the dead. Skinatrophy of depilated part was observed in severe cases, but was not very remarkable. There was no disturbance of sensation, non depigmentation of the depilated skin. Since the secretion of sweat and sebum was decreased, the depilated parts were usually dry and appeared as if dirty. The follicles ^{of} depilated hair were remarkably atrophic.

3) Prognosis of depilation

Depilation stopped after certain period and some hair remained according to the degree of the disease. At the period most of the plucked out hair had normal hair follicles. Then in the epilated parts some slender hair appeared and the regeneration of hair gradually began. On 25/IX, the 83 depilated patients were questioned concerning the time when the tendency regeneration first became manifest. The result was as following table.

Table 40.

Number of cases	appearance of regeneration						
	2nd week	3d	4th	5th	6th	7th	total
	1	1	19	17	20	2	60

23 patients showed slight depilation even at the 8th week, but 60 patients (72 %) showed tendency to regeneration not later than the 7th week. From this fact the regeneration of depilated hair is probably in almost all cases.

2. Disorder of sebaceous and sweat glands

As the effect of the disorder of these secretory glands the secretion of sebum and sweat decreased and therefore the skin became dry and lost in luster. 48 patients among 72 did not sweat even in the stage of high fever.



Relation between the degree of depilation and the disorder of sweat function was as showing in the next table.

Table 41.

Degree of depilation	sweated	non sweated	total
severe	15	11	26
moderate	8	4	12
mild	15	6	21
non epilated	10	3	13
	48	24	72

It seemed that, the degree of sweat disturbance to parallel the the degree of depilation. The disorder of sweat function may be caused by the direct effect of neutron and γ -ray. The function of these secretory glands recovered simultaneously with the re-generation of hair.

II . The Disturbance of Male Generative Function

In the study of male generative function, the potency and sperm were investigated.

1. Potency

The results concerning 22 patients consisting of 21 inpatients, and 1 outpatient were as follows:

Table 42.

	Distance f. centre	Radiation diseased	Potency			total
			decrease	normal	gradually recovered	
1. Group	0.8-1.5	yes 19 no 1	14	6	9	20
2. group	1.8-	no 2		2		2

note: 1. All were 19-43 years old, 3 of them married.

2. Investigated at the end of September.

In the 1st group 14 patients among 20 suffered from decreased potency, but their potency recovered simultaneously with the recovery from radiation disease. The 2nd group had normal potency. In 4 patients the tests were relatively smaller to palpation, ^{but we must remember that} the potency and the volume of the testis are influenced by food.

2. Sperm

Sperm of 7 patients among above mentioned was tested.

i) Volume of sperm was 1-3.5cc, average 2.4cc and notably decreased.

But the semen showed no macroscopic change.

ii) The motility of the spermatozoa was not determined in all cases.

iii) The number of spermatozoa was notably decreased.

iv) Many dead spermatozoa were found.

v) It seemed that, the shorter the distance from the center was, the severer the changes in the semen.

vi) Potency was not always parallel to the changes in the semen.

ix) Potency was in most cases weakened, but it recovered gradually with the recovery of the general health, but the effect of exposure to radiation upon the semen remained the major disturbance. Long continued observation will be necessary to determine the relation to sterility. We have no data concerning disturbance of the fertilogenerative organ.

III. RESULTS FROM ORAL-SURGICAL OBSERVATION

Our investigations upon the 171 inpatients in the Ujina Branch Hospital were carried on from Sept. 15 to Sept. 30. At this period many cases were in their convalescent stage, so that we could not make detailed examinations of the severe cases at the stage of the fullest development of the mouth diseases. The result of the examination are as follows: (see table 44)

1) Swelling of the gingiva, gingivalgia, bleeding from the giviva etc. were subjectively complained of by 38 patients (22%), and discovered by examination in 13 patients (8%). The total was 51 (30%).

2) Many oral inflammations, including gingivitis, broke out within

the period from about Aug. 25 to about Sept. 10, and this almost coincided

with the time of the appearance of petechiae, seems to be slightly later.

Name	age	distance from center	date	potency	Sperm		Spermatozoa		remarks
					volume	natur	number	motion	
Hirano	25	1.0 km	25/ IX	weakend	3.5cc	milky typical smell	50-60 field	(-)	emitted 5 a.m. proved 3 p.m.
Hirai	28	1.0 "	27/ IX	"	3.0 "	"	30-35 "	(-)	5 7 a.m.
Ohuchi	24	1.2 "	27/ IX	normal	2.5 "	"	20-25 "	(-)	5 7
Shida	26	0.8 "	30/ IX	weakend	1.0 "	"	0	(-)	6 7
Inoue	29	1.5 "	30/ IX	"	3.0 "	"	1-3 "	(-)	examined soon after emission
Abe	24	1.0 "	19/ IX	normal	2.0 "	"	1-2/ deformation	(+)	"
Yasui	34	1.8 "	19/ IX	"	2.0 "	"	7500/ mmi deformation	(+)	"
Control	23		27/ IX	"	5.0 "	"	59000/ mmi	(+)	emitted 6 a.m. proved 8 a.m.

3) The appearance of gingivitis was relatively often observed at the incisorial regions of both jaws. Otherwise the parts which are chronically stimulated by metallic crowns, plugs etc. were apt to suffer and to be more severe; i.e., here was often observed the necrotic change of the gingiva. It was not infrequently that facies buccalis suffered simultaneously.

4) The gingival border became erythematous, swelled up and bled readily following any slight stimulus. Mild cases became better after the lapse of several days. It was often observed that the mucous membrane of the mouth looked pale or anaemic and in some the erythematous signs were not distinct. In case of advancing inflammation this became gingivitis necroticans, the gingival border and the crest of the gingiva changed into a yellowish grey-white necrotic substances, which was accompanied by strong fautor ex-ore as well as inflammation of the accessory lymphatic glands and disturbance of the opening action of the mouth. The patients complained of severe pain had difficulty in eating. The necrotic substance gradually felt off through disintegration of the tissues, and there remained ulcers of various depth, resulting in gingivitis ulcerativa with tooth-ache by knocking and tooth-wandering. In cases of severe disease the inflammation developed from the gingival border, finally causing necrotic ulcerous inflammation of the mouth. Sometimes the necrosed jaw-bone, gray-yellowish, was exposed at the bottom of the ulcer. It was said that the patients who died in the early days had some noma-like symptoms. As tenseness of the pale granulation around the ulcer was often relieved, the granulation gradually improved with increasing vascularity and the ulcer became smaller. The disease got well after about 15 days under symptomatic treatment. These inflammatory disease of the mouth were considered to be the secondary changes following the changes of the blood, and to be similar to the inflammation of the mouth in case of granulocytopenia and pan-myelophthisis.

IV Injuries of the Visual Organ

1. Material and method

Investigation was made from the middle to the end of September.

163 patients in the Ujina Hospital, & 134 outpatients were the subjects of the investigation. Those who were affected by severe radiation disease and those whose vision was found to be different before and after the explosion, were examined in detail, including fundusoscopic examination. (32 of 132 patients examined funduscopically were affected by radiation disease.)

2. Results

1) Degree of injuries to visual power

No case suffered any serious injury to vision. One case observed to have cataracts had a visual acuity of 0.04, bilaterally. Another patient with bleeding at the macula lutea had a visual acuity of 0.4. Some cases who had been observed to have white flecks as petechial dispersive fleck on the retina, had almost no disturbance of vision, but others were discovered by detailed examination to have some objective as well as subjective disturbance of visual power.

2) Conjunctiva

Most patients had some increasing creamy discharge owing to carelessness. Their symptoms were not particularly severe.

3) Cornea

Some had a slight turbidity, but nobody had any disturbance caused by the radiation disease.

4) Anterior chamber

Almost transparent

5) Iris & pupil

In good order

6) Crystalline lens

One case observed at the Kusatsu first Aid Station was attacked directly by the flash of the atomic bomb, was blinded so as to be unable to distinguish light from dark for about 3 days thereafter. Recently he recovered to a visual acuity of 0.04, and some relatively mild turbidity was observed on the anterior & posterior surface of his crystalline lens.

7) Vitreum

We found one case with slight opacity of the vitreous body. On his retinal surface there were observed several petechial flecks & white flecks.

8) Fundus oculi

Livid optic papilla caused by anemia -----7

Petechial fleck or white spots -----8

3 of them, who were in Ujina Hospital, there was an intimate relation between the petechial fleck and the veins. (see fig. 15)

In addition, those patients who had looked straight at the flash of light, had a slight turbidity of the central part of the retina & extinction of the macular reflex. This might occur ascribed to solar retinitis.

V Injuries to the Auditory Sense

Investigations were made twice on Sep. 24, 25 & Oct. 1, 2 by means of Hartmann's tuning fork to determine the injuries on the auditory sense. 27 cases were examined and classified as follows;

- 7 were considered to have almost normal auditory sense.
- 11 were found to be slightly affected (two of them had otitis media)
- 9 were found to be moderately injured (one of them had otitis media)
- None was found to be severely affected (all otitis media broke out after the injury)

The type of hearing lost was not found to be specific, all showing a simple decrease of acuity. There could be found a relation between the injuries in the auditory sphere and the condition of the blood; i.e., there were many with injuries of the auditory sense among those whose blood states were abnormal. (table 45)

Table 45

w.b.c.	normal	Relation to w.b.c. hardness of hearing	
		mild	moderate
1000		2	5
2000			2
3000	2	3	1
4000	1	1	1
5000			
6000	1	3	
8000	3	2	

II Relation to r.b.c. ^{ness} hard of hearing			
r,b,c.	normal	mild	moderate
1.0 m.			4
2.0	2	8	2
3.0			2
4.0			1

III Relation to hemoglobin			
hemoglobin %	normal	mild	moderate
10			1
20			2
30		1	2
40	1	3	2
50	4	6	
60	1	1	
70	1		

At the time of explosion there were found some injuries on the side facing the blast, but no such case was observed in the examination, & both side were equally affected. The recover of the auditory sense was examined after one week from the first examination, the result showing a remarkable tendency to recovery. It might be considered to become better with the recovery of the blood state. (see table 46)

Table 46

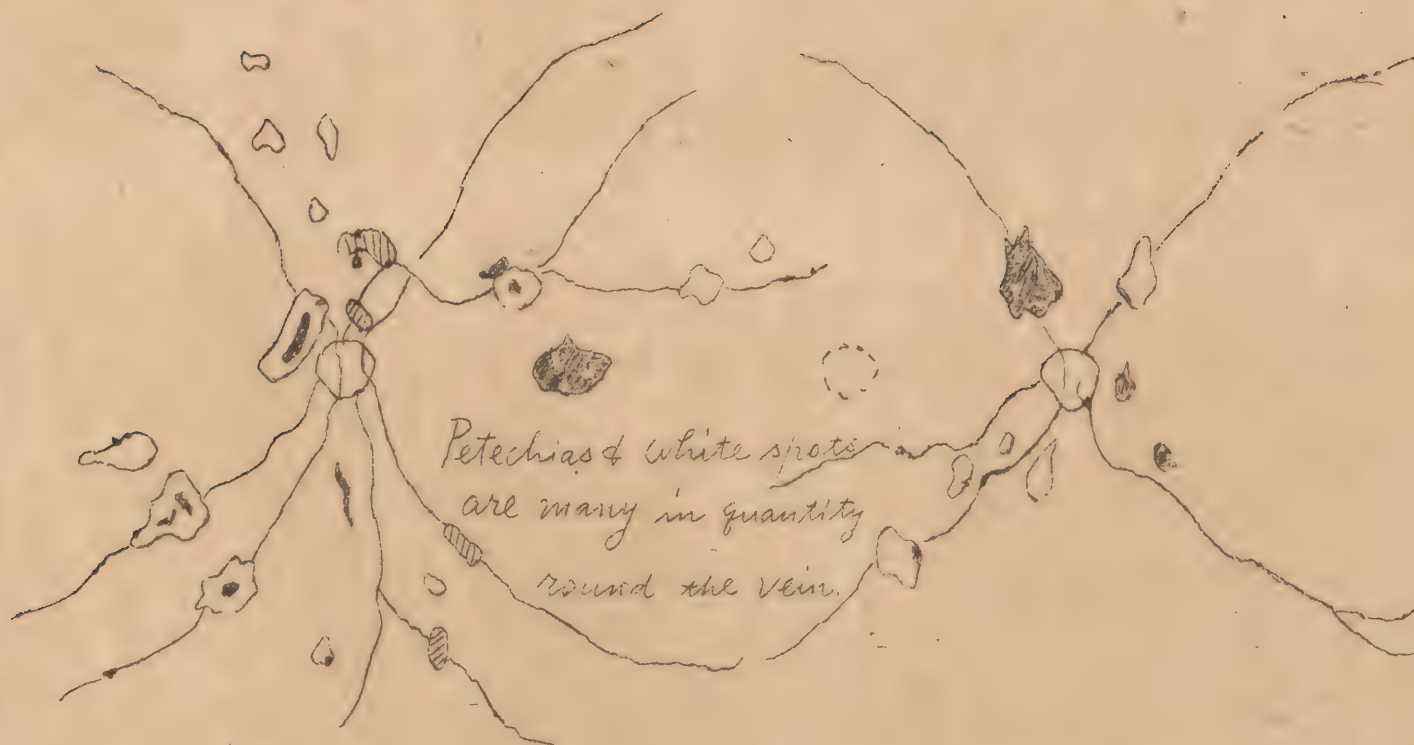
	recovered	unrecovered
mild hardness of hearing	5	2
moderate hardness of hearing	5	2

Fig. 15

K. Ishii

right eye

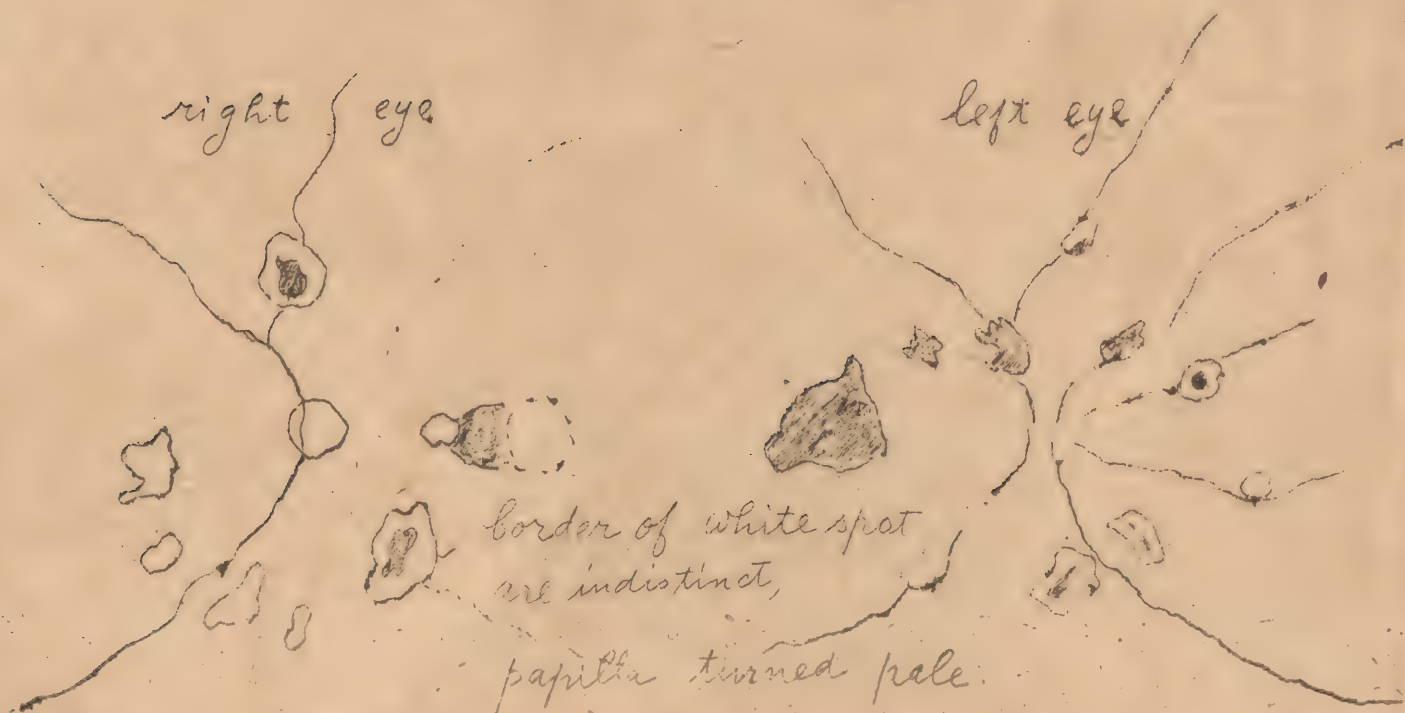
left eye



J. Tanimoto

right eye

left eye



Note: black Petechia
oblique line absorbing petechia
white white spot

PATHOANATOMICAL AND HISTOLOGICAL
INVESTIGATION OF RADIATION DIS-
EASE

I. Summary of Pathoanatomical Investigation

12 early cases (Stage I), 26 later cases (Stage II), and 8 late cases (Stage III) are described. The cases of the middle group were ~~described~~ by Dr. Miyake, the assistant professor at T.I.U.

1. Pericardium & Heart.

Subepicardial *bleeding* was more or less present in almost all cases of stage I (10 cases).

- Pericardial bleeding only 3.
- Dilatation of right ventricles 1.
- Dilatation of left ventricles 1.
- Opacity of myocardium 4.

During the II stage haemorrhage ^b becomes more marked. In the III stage pericardbleeding 1, subepicardial bleeding 3, ⁱⁿ intramuscular and subendocardial bleeding each 1. In general slight hypertrophy, especially dilatation of the right ventricle can be observed in the III stage, the colour of the myocardium is yellow-brown and soft like paste and moderately or extremely opaque. Extreme increase of epicardial fat tissue 4, fatty degeneration of papillary muscle 1 (stage III) .

2. lung

In the earliest 4 cases slight pulmonary emphysema can be observed but no other change. Subpleural petechiae 8 cases in 8, but obvious bleeding in to the lung parenchyma in only 2 ^B blood was present in the thorax in 3, but only ~~at~~ a slight extent. Engorgement and oedema of lung in 2 cases. During the II stage lung bleeding and lung oedema can be seen more often. During the III stage such a marked degree of bleeding in the pulmonary parenchyma, as can be seen during the II stage can not be found, but it is rather small. Old or new pleural bleeding can be observed in 6 cases. During the III stage it is very notable that such complications as lunggangrene (1), empyem (1), and catarrhal pneumonia (2) occurred.

Linear bleeding in the posterior mediastinal tissues is visible in one case, the cause of which, whether by haemorrhage or by traumata (for instance blast) , is impossible to determine.

3. Liver

In stage I, cloudy swelling (trübe Schwellung) or opacity of the liver can be seen often: swelling and opacity 7, opacity only 2.

At the relative end of this stage, clear cut fatty degeneration can be seen in 2 cases (died on 14/VIII and 15/VIII). No sign of jaundice. In the III stage, cloudy swelling can be seen very often, but in 3 cases there was atrophy. In almost all cases, engorgement about the central veins is very clear. Fatty degeneration 4, jaundice of liver 1.

4. Spleen

In the I stage generally the spleen is of normal size, often rather atrophic (in 3 cases), 2 slight splenomegaly can be found. The follicles of the spleen are in general indistinct (9 cases): even in children of about 13-14 years old, it is impossible to see them clearly, and in the 2 cases of splenomegaly the follicles are not clearly seen. Rupture of spleen with 200cc fluid blood in the abdominal cavity 1. In this case, we can not recognize any sign of trauma in the skin of his chest and abdomen, but we can not be certain that it is not caused by simple trauma or blast. Bleeding into the parenchyma of the spleen 1. During the II stage atrophy of the spleen becomes more marked. During the III stage atrophy can be seen in 4 cases, and even in those cases which have the complication of sepsis, pneumonia or empyema, and strong tendency to atrophy of the spleen can be observed rather than splenomegaly. In general, the follicles are indistinct as can be seen in the I stage, but the trabeculas are relative easier to see. Its consistency is soft or slightly fragile and the parenchyma of most cases in the III stage can not be easily scraped from the cut surface.

5. Kidney

In the I^{stage} swelling and opacity 8 cases. Opacity only 4 cases, Petechia or linear bleeding in the parenchyma 1 case.

5. Kidney

In the stage I swelling and opacity 18 cases. Opacity only 4 cases. Petechia or linear bleeding in the parenchyma 1 case. Petechiae of ^{sub}mucosa of the renal pelvis can be observed in almost all cases. Marked engorgement 1 case. In the II stage, fatty degeneration and extreme bleeding not only into the parenchyma but also sub-capsular haematoma ^{can} be observed. In the III stage swelling of the kidney 5 cases. The colour is red grey or grey. The tension of the capsule is increased and it strips with ease. They are slightly soft and on the cut surface moderate engorgement can be seen. The marking of the cut surface are often unclear. Acute glomerulo-nephritis with miliarry abscess of kidney, 1 case. Abnormal dilation of kidney-pelvis, 2 cases, and submucous bleeding of the renal pelvic tissues, 2 cases.

6. Adrenal Gland

In the I stage, atrophy can be observed macroscopically in 8 cases, but this is not severe. Atrophy of both medulla and cortex in 5 cases, of cortex only 1 case, of medulla alone 2 cases. During the II stage, the atrophy becomes more severe. In the III stage diffuse atrophy can be observed; especially atrophy of cortex 3 cases; of the medulla 4. Generally the lipoid of cortex disappears in a spotty manner. Bleeding into capsule and cortex each 1 case.

7. Neck Organs

I stage : changes in the tonsils in 3 cases (hypertrophy of left side 1; tonsillitis purulenta et gangraenosa of both-sides 1; tonsillitis lacunaris dextra 1). Stomatitis and gingivitis can be observed in 1 case (11th), who died as a result of sepsis. The

thyroid glands shown macroscopically no changes except for 1 case of atrophy. **II stage: Angina gangrenosa, stomatitis & pharyngitis occurs oftner than in I stage.**

III stage: angina gangraenosa 3; tonsillitis purulenta bilateralis

1; peritonsillar abscess 1. Atrophy of the ⁿtonsils can be observed in 2 cases; but the lingual tonsils are relatively prominent. This is a notable fact. Atrophy of the thyroid gland can be seen in 4 cases and grossly it appears as if there were lack of colloid substance

but engorgement of the interstitium is apparent.

8. Pelvis and sexual-organ

I stage; Macroscopically no changes.

II stage; notable atrophy can be seen very often.

III stage; atrophy of testis 3; atrophy of ovary with bleeding 1 case.

9. Brain

I stage; in general, hyperaemia of pia mater or slight opacity can be seen often. Severe meningitis serosa 1 case. 4 cases of bleeding into the brain substance or pia mater are found. Among these, bleeding occurred at the end of this stage in 3 cases. It is a notable fact. In 1 case damage of the brain substance by trauma can be seen.

II stage; Oedema and opacity can be seen often and in general, the tendency to bleeding is more severe than in I stage.

III stage. All symptoms decrease ^{by} bit bit as time goes on. But oedema and opacity of the pia mater can still be seen in 2 cases. Hyperaemia of pia mater 1; bleeding of choroid plexus 1 increase of fluid in lateral ventricle 1; brain-abscess 1 resulting from penetrating wound.

10. Bone marrow

I stage

Humerus of 8 cases. (One of them a 13yr old girl) is examined. In most of the cases, it is soft, watery and yellowish bone marrow in which lack of cells is observed; one of them appeared partly like red marrow.

II stage

Half or 1/3 of the femur contain red marrow, but the marrow is yellow in several cases. In cases with severe leucopenia, decrease of myeloid cells and megakaryocytes and marked increase of resembling plasmacell can be observed. Monocytoid cells are also found in the peripheral blood. By the ^{ob}serva^{ti}on of plasmacell in supravital stains, the appearance of numerous neutral red granules about the nucleus and mitochondria can be seen.

III stage

Red marrow of upper half in 5 cases and of upper 2/3 in 1 case can be seen.

Other parts of the bone marrow consist of adipose tissue (4), colloid (2 cases) or pyoid (2 cases) marrow. Bleeding can observed in some of them.

11. Thymus gland

Parenchyma can be seen in 2 cases, one of them is a 13 ys. old boy and the other a 15 ys. old boy. Otherwise no change.

12 Lymph gland

I stage

In general, atrophy of the glands can be seen, and among those 7 are very severe. The cut surface generally looks dark red.

II stage

Atrophy becomes more extreme.

III stage

Atrophy is also extreme and the cut surface is pale red and does not look like marrow. As time go on, slight swelling of the lymph gland of the neck and mesentery are observed in 4 cases. This is a notable fact.

13 Stomach

I stage

No contents in most cases and a little pulp like fluid is seen in several cases. The colour of mucous membrane appears ~~in~~ yellow in many cases. Slight catarrhal change in 4 cases. Bleeding of mucous membrane near cardiac end on the greater curvature in 8 cases.

Among these one has a recent ulcer with a black brown covering as large as a red bean.

II stage

The gangrenous and haemorrhagic ulcers of the mucous membrane become severe. In some cases the distribution of these is as in the

I stage.

III stage

Submucous bleeding in 3 cases (2 of them bleeding along the entire stomach and last one bleeding in the pyloric end with formation of a shallow ulcer in this part)

Catarrhal change 2 cases

Atrophy of mucous membrane 3.

14. Intestine

I stage

In general, slight catarrhal change and edema of the mucous membrane of the large intestine can be seen. It is especially notable that pseudo-membranous inflammation or ulcer is found in 3 cases, died later. Numerous shallow ulcers and erosion of the mucous membrane with bean or dewdrop-sized, yellowish gray pseudomembranous covering from the caecum to the upper part of the rectum are found in the first case, and a shallow bean-sized ulcers in the duodenum and the first part of the intestine in the second case, and pseudomembranous inflammation of the large intestine in the third case. Bleeding occurred in the mucous membrane of the duodenum in 3 cases, and of the small intestine in 2 cases. In 2 cases the lymphoid apparatus become more distinct, in the other cases it was normal or indistinct.

II stage

Gangrenous inflammation, bleeding and ulcer mainly of the large intestine and the rectum, occasionally in the lower part of the small intestine, are seen more frequently and more widely than in I stage.

III stage

There can be seen some changes but not so severe as seen in the II stage. Pseudo-membranous inflammation in 2 cases, submucous bleeding in 2 cases (throughout the intestine in 1 case, rectum in 1 case). Atrophy of mucous membrane and indistinctness of lymphatic apparatus 3 cases.

15. Hypophysis

Congestion of vessels of the cut surface can be seen in almost all cases, otherwise no changes.

16. Pancreas

I stage

Macroscopically no change is found.

III stage

Atrophy with indistinctness of structural markings in 1 case, with severe fatty degeneration of the cellular substance in 1 case.

Extreme congestion of interstitial vessels can be seen.

17. Skin

I stage

Almost all cases except one have more or less the complication of burns, which are of the 3rd or 2nd degree with dirty black and brown coverings. The edge of the burned area has a red halo and is sharply defined. On the cut surface in the relatively superficial layers of the subcutaneous fatty tissue, bleeding points or necrobiosis can be seen. In one case, change throughout all layers is observed. No sign of depilation.

II stage

In almost all cases slightly burned or in the recovery stage of the burns (2nd or 3rd degree). Mark of depigmentation here and there, wounds in the recovery stage with elevated and brown granulation tissue are often seen.

III stage

Almost all cases of burns are already in the recovered stage with pigmentation or depigmentation. Severe and wide burn of 3rd degree in 3 cases, one of them infected. In general the skin appears pasty and dull. Depilation has already ceased and at the margin of depilated area, regeneration of hair can be seen.

18 Haemorrhage

I stage

The degree of haemorrhage is not so extreme. The frequency of bleeding of various organs is as follows: subepicardium (10), mucous membrane of renal pelvis 9(10), pleura (8), mucous membrane of stomach (8), pericardium (3), duodenum (3), brain-substance (3), mucous membrane of intestine (2), conjunctiva (2), skin (2), Lung-parenchyma (2), spleen (1) and meninges (1). It must be noted that bleeding of subepicardium, pleura, mucous membrane of kidney-pelvis and stomach occurs early and frequently. On the contrary, bleeding of the skin and brain-substance occurs later (later than 8th day of disease).

II stage

More extreme haemorrhage is seen, but it decreases ^{at} the end of this period. Bleeding can be seen in the serous membranes and the pelvic mucous membrane of kidney, prostate, skin, pericardium, endocardium, epicardium, subpleura, stomach, intestine, oesophagus, trachea and urinary bladder.

III stage

Almost all the hemorrhage is petechial and very slight. Frequency of bleeding is as follows: pleura (6), submucous part of kidney-pelvis (4), subepicardium (3), stomach (3), urinary bladder (3), intestine (2), pericardium (1) and sub-endocardium (1).
(see table 47 and 48)



Summary of the Patho-histological Observations

Three stages in the progress of the pathological change in early cases (stage 1), in later cases (stage 2) and in late cases (stage 3) will be described:

1. Heart.

In the 1st case, without burns, there were no changes, except haemorrhage in the myocardium.

Half of the cases with burns showed degeneration of cardiac muscle fibres (fatty, vacuolar, waxy etc). In 2 serious cases the muscle fibers were found to have undergone lysis. The majority of such cases showed simultaneously cellular exudate and in 1 case the cellular exudate was observed alone (without any other change).

The cells in the exudate are mainly ~~lymphocytes~~ histiocytic cells, lymphocytes and plasmacells, while polynuclear leucocytes were rarely to be seen. In 1 case mononuclear-cells with abundant plasma were observed. In addition to those changes, we saw, in 2 cases, oedema among the muscle fibers. In 5 cases out of 8, with cellular exudate, changes were seen in coronary bloodvessels and other narrow vessels, such as swelling of the vessel wall, thickening of intima, swelling or detachment of endothelial cells, deposit of fibrin on parts of the wall and in certain cases perivascular cellular infiltration. Generally, the endocardium showed no special change and only in 1 case, with clinical manifestation suggesting sepsis, change of early circumscribed endocarditis were found.

Intermediate stage: The changes in the bloodvessels and parenchyma were increased, where the haemorrhage and degeneration of cardiac muscle fibers were more striking.

Later stage: The changes in the bloodvessels and parenchyma gradually disappeared, and slight waxy degeneration, and condensation of nuclei were the only changes, including 3 cases with waste pigment deposit and 1 case with segmentation of cardiac muscle fibers.

3 cases with serious burns, showed exudation of histiocytes and lymphocytes. In 1 case with a suppurating burned area, oedema of endocardium round cell infiltration were found, and in the 2nd case without burn, there was fibrinous thrombosis of the coronary vein.

2. Lung

Histologically, there was slight or moderate pulmonary emphysema, in 6 cases (No. 1-No. 6) and haemorrhage in the lung parenchyma in 3 cases (No. 2, 3 & 4).

In the 2nd case there was haemorrhage in a relatively large area, ~~also~~ also in the pleura and thoracic cavity together with moderately pronounced lung emphysema, but here we must take into consideration the fact that this case had wounds only without having any kind of burn.

In 4 cases, cellular infiltration was observed in some parts of the parenchyma and especially in the alveolar walls. This infiltration was composed mainly of a large number of mononuclear round cells and lymphocytes, but leucocytes were seen in small number and fusiform cells were found here and there. 2 cases showed moderate pigment deposits.

Changes such as swelling of moderate sized blood vessels subintimal oedema, detachment (in some cases), and degeneration and necrosis of the endothelial cells were observed in 4 cases. In the 1st and 7th cases, the epithelial cells of the bronchioli were, more or less detached and exudative change was recognized. In two instances of relatively late cases (No. 11 & 12) among the earlier cases, there was pulmonary oedema.

Intermediate stage: - Degenerative change in blood vessel walls in this stage is more evident than in those of the earlier stage and majority of cases showed pulmonary oedema and haemorrhage while the foci, which looked like lung gangrene, were rarely found.

Later stage: - In only 1 case lung emphysema was observed. In the other cases there was moderate or advanced atelectasis. Excluding the fact that the number of leucocytes was relatively small and that the acellular exudate was comparatively abundant (with fibrin in certain areas), features of bronchopneumonia and gangrene, seen in these cases, coincide morphologically with those of ordinary cases.

in cases with extensive burns, haemorrhage and edema of lung were already gone, and in some parts ferruginous cells were seen in the alveoli and in their walls. The walls of the alveoli, being infiltrated by plasma-cells and small round cells, were generally seen to be thickened.

In many cases, walls of small vessels and the endothelium showed no special changes, but there was remarkable ~~vascular engorgement~~.

A fibrin thrombus in a ~~pulmonary~~ artery was seen in I, case, in a later stage.

3 Liver.

Almost identical features were seen in II cases with burns. All the liver cells showed degeneration (cloudy, fatty and vacuolar) or necrosis. In 7 cases relatively circumscribed foci of necrosis were observed and there was infiltration, mainly of lymphocytes, plasmacells, histiocytes and sometimes of giant cells, while infiltration of polynuclear leucocytes was rarely found. The localization of necrotic foci was not be uniform. They were found most frequently about the central veins or close to them, or sometimes, as in cases No. 9 & 12, they could also be found near Glisson's sheath.

Disse's space was more or less enlarged and often contained vague albuminoid substance. The stellate cells were found to be swollen, increased the number and detached and often contained ~~hemosiderin or~~ erythrocytes.

In many cases cellular infiltration was seen, more or less, at Glisson's sheath. This infiltration was composed mainly of small round cells, while polynuclear leucocytes and histiocytes were extremely small in number.

In the case of the bloodvessels, thickening and swelling of endothelium, edema beneath the intima, swelling and detachment of endothelial cells were seen in the majority of the cases; and sometimes degeneration and necrosis were found.

^{no} Haesiderin deposits were also observed, but generally in light degree.

In the 2nd case, without burn, the changes were remarkably slight in

contrast with those just described.

Myelocytes were never found.

Intermediate stage:-central atrophy of the lobes and fatty degeneration were observed in many cases. In the burn cases, there were observed, necrosis, enlargement of Disse's space with contained exudate, slight increase of the stellate cells with phagocytized erythrocytes.

Later stage:- Cloudy and swollen liver-cells were relatively prominent. Peripheral fatty degeneration, vacuolar degeneration and atrophy of the liver-cells were also observed. Central degeneration and necrosis were found in 4 cases (3 of them with burns). There the stellate cells were more or less enlarged and proliferated and distention of bile capillaries was seen. In cases with burn, the features of so-called "serous hepatitis" were distinct.

Swelling and proliferation of stellate cells with phagocytosis of haemosiderin, and foci of necrosis were also to be seen in some parts.

Cellular infiltration of Glisson's sheath was observed in 5 cases, one of which showed groups of myelocytes. In case No. 8 fatty degeneration was striking and the whole liver looked like a lump of fat and could float on the surface of water. In the 2nd case jaundice of liver was observed.

4 Kidney.

Earlier stage:- In the 2nd case, without burn, no remarkable change was seen in glomeruli and slight albuminoid degeneration ^{of the} convoluted tubules was observed.

In 11 cases with burn, on the contrary, various kinds of degeneration (albuminoid, cloudy, swelling and sometimes granular degeneration) were seen in the walls of the urinary channels, especially of the convoluted tubules; in several cases features of slight glomerulonephritis were seen. In the 11th case, with clinical manifestation of sepsis, we observed typical glomerulonephritis and high grade parenchymatous degeneration of the urinary channels.

Intermediate stage:- Blood in Bowman's capsules was found relatively often, and generally the epithelium of the convoluted tubules looked

and swollen and in their lumina albuminoid coagula were contained.

In 1 case, which showed the features of giant white kidney macroscopically, necrosis was manifest microscopically also, and the nephrons in some parts showed atrophy.

Later stage:- Glomeruli were usually unchanged, but sometimes the loops looked swollen and the capillaries of loops showed the slight increase of endothelial cells. The epithelial cells of the convoluted tubules, like those of the earlier stages, showed various kinds of degenerative change. In certain case, the epithelial cells were atrophic and flattened thus making the lumen broad, in which a big amount of albuminoid substance was contained. Congestion of small vessels was generally apparent.

In the cases, with burns, degeneration of the epithelium-cells of the tubules and capsules were striking and in consequence the albuminoid substance in the lumina was abundant, while the parenchyma was generally irregular and oedematous.

In the second case, with the septic manifestation, haematogenous military abscess and acute diffuse glomerulonephritis were observed, but typical nuclein proliferation of the loops was not found.

5 Spleen

The spleen follicles, in each case, looked remarkably atrophic and irregular, and in serious cases only remnants were to be seen of the follicles had completely disappeared.

The number of cells was reduced and condensation of the nuclei was observed.

In 5 cases hyaline metamorphosis was observed in lymph follicles or in the location corresponding to them. Nothing was found to suggest regeneration of the lymph follicles. The central artery, in many cases showed such changes as thickening, swelling, irregularity, hyaline degeneration and necrosis of intima or oedema beneath the intima; the endothelial cells looked swollen, detached, and frequently contained phagocytized haemosiderin; while, in some cases, condensation of the nuclei, degeneration and necrosis were also observed. The spleen itself, generally speak-

ing, showed the feature of decrease in the number of cells. Giant cells were found in only 2 cases (No. 4 & 7). Condensation of nuclei was seen relatively often among the splenic cells. In the 11 case, splenitis was apparent.

The splenic sinuses were generally enlarged and showed poverty in erythrocytes while in 3 cases, in circumscribed area lake-like dilations of the sinuses was seen, and in 2 cases (one of which had suffered on injury in the spleen) actual bleeding was observed.

The sinus-endothelial cells were swollen and proliferated in the sinuses, and some contained haemosiderin and others erythrocytes.

In certain cases, condensation of ^{the} nuclei of reticular cells was observed. The fibres of the reticular connective tissue were not increased, but gave the strong impression of thickening. In the 2nd case, without burn, haemosiderin deposits were not striking, but in the somewhat later cases, the deposit was seen to be increased.

Intermediate stage:- The lymph follicles showed marked atrophy, while the reticular cells remained relatively intact and the fibrous reticulum was not increased. In the burned cases and more or less also in the case without burn, fibrinoid degeneration was present in the wall of the central artery and hyaline deposit in the follicle was also frequently observed. Cases with proliferated sinus-endothelium, phagocytosis of erythrocytes and other cells, were more frequent than in the earlier stages.

In later stage:- Remarkable atrophy of the follicles was observed. Degeneration of the wall of the central artery, sometimes of slight degree was in 4 cases and hyaline degeneration in the follicles was seen in two cases. Decrease in the number of cells in the pulp was seen in 4 cases, where the number of the reticular cells were not so markedly decreased. In those cases, in which the pulp cells were increased in numbers, they were mostly plasmacells or large lymphocytes. In the cases, with burn or pseudomembranous intestinal changes, a few polymorphnuclear leucocytes were observed.

In 1 case (No. 7) giant cells, with condensation of nuclei, were found.

The sinuses were broad in 6 cases and in part showed lake-like dilatations and the endothelial cells, in 4 cases, appeared moderately proliferated. Haemosiderin deposits were seen in 5 cases and these showed also phagocytosis of erythrocytes and other cells. The majority of the cases showed, if not so as in the cases in earlier stage, degenerative change of the pulp cells.

6. Suprarenal capsule

General atrophy was seen in many cases and atrophy of medulla was somewhat more evident than that of the cortex. In some cases slight degeneration or necrosis of the cortex or medulla was recognized.

There were 2 cases, in which circumscribed infiltration of small round cells near the border of cortex and medulla was observed.

Intermediate stage:—Atrophy of cortex became marked and the medulla appeared irregular. compared to the earlier stages, was seen

Later stage:—No marked change, except that in a few cases condensation of nuclei or poor staining quality was seen in the globular layers. In the few cases perivascular cellular infiltration, as mentioned above, was seen and in general, dilatation of blood vessels was remarkable.

7. Neck organs

a. Thyroid gland

In 3 cases atrophy with decrease in the amount of colloid, basophilic and vacuolar degeneration and detachment of epithelial cells was observed. In one of these 3 cases marked atrophy was seen.

Intermediate stage:—Not so much different from the earlier stages.

Later stage:—As in the earlier stages, colloid was generally decreased in quantity and the greater part of the follicular epithelium was seen to be flattened. In the burned cases, we observed vacuolar degeneration of colloid, haemorrhage, basophilia, slight relative increase of stroma and distinct congestion of blood vessels.

b. Tonsils

Atrophy of the follicles was commonly seen, and in most cases the germinal centres appeared ill defined. (The same occurred in the

cases with gangrenous change)

The epithelium showed no remarkable change, but in the inflammatory or gangrenous areas it was partially detached or destroyed. At the periphery vacuolar degeneration was observed and appearance of the leucocytes was generally poor.

Intermediate stage:- Not so much different from the appearance in the earlier stages. The epithelium showed no remarkable changes, excluding few cases which showed vacuolar degeneration in the cells of the germinative strata. Although the follicles looked atrophic, some of them were seen to be rich in plasmacells and reticular cells.

Later stage:- Atrophy was moderately marked, while degenerative change in epithelium was not so striking. In the areas of inflammation or gangrene, we observed cells like plasmacells or small numbers of leucocytes. It was not evident whether these originated in site or come from elsewhere. Irregular germinal centres were seen in 1 case with advanced tonsillitis.

3 Pelvic organs & sexual organs

1) ~~Pelvic~~ organs:- No remarkable change.

2) Sexual organs

a) Testicle and epididymis

The spermatogonia showed no remarkable changes ~~while~~ while the spermatids, as well as sperms, although not markedly altered and displayed poor staining properties.

Intermediate stage:- Usually the testicles showed extraordinary atrophy and there were such extreme cases ~~as~~ showed the seminal tubules covered by Sertoli's cells only. In general cessation of growth of the spermatids was thought to be the important change. The interstitial connective-tissue was seen slightly increased in some cases. Such ~~kinds~~ of change as are mentioned above were more marked nearer to the capsule.

Later stage:- We observed the relatively large number of cases, in which the decrease of spermatogonia was seen, while there were many cases showing no remarkable change in Sertoli's cells. A moderate

increase of interstitial connective tissue cells or congestion of the bloodvessels of the parenchyma were observed. Degenerative changes in the epithelial cells or marked epithelial detachment of the tubules of the epididymis, with consequent enlargement of the lumen, were observed.

b) Ovary

Hyperchromasia with condensation of nuclei was observed in some follicles.

Intermediate stage:- We observed in some cases extraordinary decrease of ovarian follicles, thinning of the granular membrane or complete disappearance of the growing forms of the ovarian follicles.

Later stage:- we observed in some cases a small number of ovarian follicles, or almost complete disappearance of Graaf-follicles and poor ~~staining~~ staining quality or nuclear condensation of the cells of the follicles.

9 Brain

~~Investigating~~ studying changes of bloodvessels, we found dilatation and congestion of the capillaries, dilatation and irregularity of the lymph spaces around the blood vessels and sometimes the appearance of small number of lymphocytes where the change of the wall was not remarkable.

In a few cases, degeneration of nerve cells of the cortex was observed with such changes as disappearance of nuclei, dissolution of Nissl's corpuscles, disarray of cells, anaemic change and atrophy; all of these changes were, however, relatively slight. The glia cells were seen in some cases to be slightly increased in numbers. In 1 case degeneration of Purkinje cells in the cerebellum was observed.

Later stage:- No remarkable changes were found among the glia cells but Purkinje cells as well as nerve cells in the brain cortex showed still degeneration, which was however very slight and gave us the ~~the~~ impression that recovery was under way.

10 Bone marrow

~~The~~ The appearance at all stages was similar. Generally there was fatty marrow with extraordinarily small numbers of cells, while the capillaries, on the contrary, were dilated and congestion was evident.

No haemorrhage was observed. Myeloid cells and erythroblasts and ~~monoblasts~~^{normoblasts}, when found, were small in number and mature leucocytes were rarely found, and lobulated leucocytes were hardly ever observed. The megakaryocytes had completely ~~disappeared~~, or even when found (3 cases) they were extremely small in number and showed condensation of nuclei. The majority of the myeloblasts and myelocytes showed degenerative changes, such as swelling or oedema and etc., combined with pyknosis of the nuclei. Among the cells of the reticular tissue, condensation of nuclei was also observed. None of them showed phagocytosis of erythrocytes.

In some places, cells resembling lymphocytes and plasma cells were seen and the nuclei of these cells showed a tendency to condensation.

In ~~32/224444~~ 2 cases deposits of fibrin were observed.

Intermediate stage:- Myeloblasts, promyelocytes, plasma cells and reticular cells existed in small numbers and haemorrhage was seen here and there. At the end of intermediate stage, various kinds of ~~as well as various kind of myeloblasts, metamyelocytes, reticular cells and lymphoid cells made a sporadic appearance. Megakaryocytes, in small numbers, and a few normoblasts~~ were also seen.

Later stage:- Generally speaking rich in cellular elements. Various forms of myeloid cells and metamyelocytes other than myeloblasts, lymphocytes and cells resembling plasma cells were observed and, although in small numbers, eosinophilic cells also appeared. But the various kinds of mature leucocytes were relatively small in number to indicate the features of so-called "agranulocytosis".

Erythroblasts showed a tendency to increase gradually and in few cases macroblasts were observed.

~~In 22/1122/22~~ In earlier stage no megakaryocytes were seen but later these, showing condensation of nuclei, appeared gradually, sometimes even megaloblasts were observed. We saw no haemorrhage in the bone-marrow but capillaries were very much dilated and in parts there was slight haemosiderin deposition.

11 Lymph gland

The majority of cases showed severe atrophy as seen macroscopically. The lymphfollicles were shrunken and irregular and the germinal centers were also not clearly defined, but appeared as vague remnants. We observed ~~decrease~~ a decrease in numbers of cells especially of lymphocytes. Condensation of nuclei was often seen and the reticular tissue was relatively well preserved.

In some cases, cells resembling plasma cells were evidently observed ^{cri}. Generally, the lymphsinuses were dilated and contained many erythrocytes. Dilatation and congestion of capillaries were often seen. The ~~sinus~~ sinusendothelial cells were a little swollen and proliferated and many of them contained haemosiderin.

Intermediate stage:- The majority of cases showed marked decrease of lymphoid tissue, relatively broad sinuses and moderate enlargement and proliferation of the endothelium. Sometimes there was exudate in sinuses. In cases with burns the sinuses were often full of erythrocytes and the ~~endothelial cells~~ endothelial cells contained phagocytized erythrocytes and haemosiderin. The ~~general~~ germinal centres were seen only in extremely rare cases.

Later stage:- There was relatively remarked atrophy as in the intermediate stages. The cervical and mesenteric lymphglands often showed marked sinusitis with increase of cells of the parenchyma.

In our opinions, the special character of pathological change of these cases are interested by the fact that even in the case of sepsis, swelling was striking. Generally speaking, it would have been understood that the reddish colour of the cut surface of the lymphglands of these cases was caused by erythrocytes which filled up the sinuses, but on the other hand it can be explained, that it was influenced ~~by~~, though slightly by phagocytosis of erythrocytes by the reticulo-endothelial cells and deposition of haemosiderin.

12 Stomach

Macroscopically, we observed, in many cases, haemorrhage in the ^u ~~co~~ membrane, and slight cat^arrhal change in about half of the cases but infiltration of cells, especially ~~of~~ of polynuclear leucocytes



was very rarely found. In 1 case we saw a fresh shallow ulcer with necrotic substance on its surface, where cellular infiltration was slight. In another case we saw marked proliferation of the cells of the stomach wall.

Intermediate stage:- In some cases haemorrhage in the lamina propria of the ~~mucosa~~ membrane was seen. In some cases the pseudomembrane was extremely superficial, with slight damage of the mucosa.

In many cases the chief cells of the stomach showed no ~~very~~ remarkable changes, but in some cases the cells of wall showed a greater or lesser tendency to increase. The accessory cells showed rather more marked degeneration. Relatively little change was seen in the epithelium.

In the later stage the changes were seen similar in kind to those, in the intermediate stage, but they were generally slight.

13 Intestine

Many cases showed oedema beneath the mucous membrane and slight catarrhal change in the intestine and colon. The majority of cases showed atrophy of the lymph follicles and in 2 cases, which were especially atrophic, we observed microscopically irregularity and poverty in cells. 3 cases showed ulcers (colon, upper part of intestine and duodenum) and their localization was not always definite, in some cases corresponding location to that of the follicles and in others not. These ulcers contained more or less necrotic substance and showed slight infiltration of cells, particularly of polymuclear leucocytes. In 1 case pseudomembranous ~~inflammation~~ inflammation was seen in the colon. The features of this were not different from ordinary pseudomembranous inflammation, and the cellular infiltration was mainly of lymphocytes and plasma cells.

Intermediate stage:- The changes in the intestine resembled those of the earlier stages oedema of the mucous membrane, haemorrhage and pseudomembranous degeneration could be counted as characteristic.

The later stages also showed approximately the same conditions, but they were relatively slightly. In cases with extensive burns, pseudomembranous and necrotic changes were seen all over the colon. Where



mucous membrane, ~~remained~~ remained, it was in part proliferated to form polypi.

generally no remarkable changes was seen in the surface, ~~epithelium~~ epithelium and the ~~of the glands~~ of the glands and atrophy of the ~~parafollicles~~ follicles was moderate, while the bloodvessels of mucous membrane and submucosa were moderately dilated. In some parts round cell infiltration surrounding the bloodvessels was seen.

I4 Pancreas

No marked change in the acinar cells, the islands of Langerhans looked generally irregular and greater their borders for the most part were not distinct. The cells of islands showed slight degeneration. There were few other cases in which the islets seemed to be enlarged, but these were found to be caused by oedematous changes.

Intermediate & later stage:- Both stages showed somewhat like the earlier cases, including I relatively late case which showed a little increase of parenchyma and moderate atrophy of pancreas.

I5 Hypophysis

Relatively many of basophilous cells showed degenerative change such as vacuolar ~~degeneration~~ degeneration, condensation of nuclei, ~~coarsening~~ tinktorial qualities of the cytoplasm and in I case a relative increase of the eosinophilic cells (posterior part of anterior lobe).

In general there was dilatation of the capillaries of the parenchyma.

No remarkable change was observed in the intermediate and posterior lobes.

Intermediate and later stage:- Change like those of the earlier stage were observed.

2 cases, in the later stage, showed degeneration of eosinophilic cells and the cases with burns, showed the ~~degeneration~~ intermediate lobes, rich in colloid with various kinds of epithelial cells such as were present in the anterior lobe.

Also it was observed that an acidophilic colloidal substance was ~~seen~~ seen among the cells of the anterior lobe.

16 Thymus

Severe or moderate atrophy of lymph tissue was observed. No remarkable change of the epithelial cells other than slight degenerative changes.

17 Salivary gland

Intermediate stage:- Slight changes were seen in the gland cells of the straited parts of the submandibular gland ducts. These showed narrow lumina which indicated the cessation of secretion.

18 Skin

Histologically certain remarkable changes were seen, even in the areas where there were no obvious burns. The majority of the nuclei of the granular strata disappeared or showed necrosis, leaving only shadowy remnants. The prickle-cells in the germinal layer showed vacuolar degeneration and their nuclei showed distinct hyperchromasia of the nuclear membrane. The basal cells also were not normal in that. Their nuclei were pyknotic. Pigment granules had almost disappeared. The corium was seen, in many cases to be oedematous, and the capillaries of the papillae and other small vessels in corium generally showed congestion and in the neighbourhood could be distinguished infiltration of mononuclear cells with clear nuclei. Polynuclear leucocytes were few. Pigment cells were almost absent. Both sweat gland and sebaceous gland showed atrophy, chiefly of the former. The connective tissue of the hair roots showed, in many cases hyaline degeneration. In the hairsack between the base of the hair and the inner sheath there was a space and the inner sheath was not clearly recognized. The vacuolar degeneration was especially marked in prickle-cell strata of the outer sheath. In cases, with serious burns the epithelium was completely lost and some of them showed necrosis in the deep layer of corium with crusting. In its neighbourhood round cell infiltration was seen, which occasionally contained a large number of polynuclear leucocytes. Some of the cases showed dilatation and congestion of the blood vessels, swelling of the walls of the vessels, degeneration and necrosis or marked swelling and proliferation of endothelial cells, and marked perivascu-

lar basophilic cell-infiltration.

In some parts, haemorrhage was seen. Such changes in bloodvessels were seen even in those which entered the deeper parts of the skin. The hair roots showed, near the surface of the skin, necrosis or degeneration with necrosis and, in the deep part of skin, condensation of ~~surrounding~~ nuclei, vacuolous degeneration of surrounding tissues and outer sheath. In cases, with slight changes, condensation of nuclei of epithelial cells was seen in corium. In intermediate or later stages, we often observed, in the corium, cords of epithelial cells, atrophic and flattened, which might have been produced by metamorphosis of atrophic hair-roots and sweat glands. The sweat glands and sebaceous glands also showed atrophic or necrotic changes and some of them showed in their vicinity marked cellular infiltration.

Cell infiltration and degeneration and necrosis of endothelial cells of bloodvessels were seen also in the subcutaneous tissue and in some cases haemorrhage was seen.

The epithelium of the cells of the alopecic areas did not always appear remarkably atrophic, but the corium was very thin and poor in hair. Hair roots, if preserved at all appeared atrophic and showed cessation of ordinary growth. Some showed microscopically ~~regeneration~~ of hair root.

Atrophy of sebaceous glands was also remarkable.

The sweat glands also, in majority of cases, showed more marked atrophy than that seen in sebaceous glands. But as a rule no inflammatory reaction was observed.

THE EFFECTS ON THOSE WHO ENTERED THE BOMBED

AREA AFTER THE EXPLOSION

The effect of radiation from the bombed ground was investigated upon the people, who came to Hiroshima after the bombing, from areas beyond the any possible influence of atomic bomb, and who then stayed or worked for a relatively long time in the bombed area.

I Investigation of soldiers

1. 10th Engineering Training Corps

a) The investigated units & outline of their behavior

(1) Ishizuka unit

From the evening of Aug. 6 to 11, they camped at Kamiyacho (0.3 Km east of the center) & were engaged in the excavation of the dead and others in the district of Kamiyacho, Hachobori and Otagawa (all within 1 Km from the center). On Aug. 12 they changed their camp to the Saving Office (1.8 Km south from the center) and worked near this camp till Aug. 16.

(2) Shimizu unit

They worked from Aug. 8 until 11 near their several camps. Their camps on Aug. 8 was at Gunjinkaikan at Hachobori (0.5 Km north-east of the center); on Aug. 9, at Merchant-Club at Tenjincho (0.2 Km from the center) and on Aug. 10, at the Hiroshima University (1.5 Km south of the center).

(3) Hongo unit

They helped to accomodate the patients in the Ninoshima Field Hospital & were supposed to be free from radiation effects.

All members of these three units belonged to Tokkotai, were under 20 years of age and had been at Konoura (Etajima) at the time of bombing.

b) Results of investigation (on Sept 3)

(1) Sedimentation rate (per 60 minutes)

	0 - 10	10 - 20	20 - 30	30 - 40	40 - 50	total
Ishizuka	46	12	3	4	1	66
Shimizu	47	6	2	0	0	55
Hongo	53	3	0	0	1	57

(2) Count of w.b.c.

The number of w.b.c. was counted of those soldiers, whose ^sedimentation rate was increased above 30, none was under 5000.

(3) Physical examination

^some complained of diarrhoea and rise of temperature, but the causes of these illnesses were evident. NO one was observed who showed depilation, hemorrhagic tendency and malais ascribable to radiation.

2. Ujina Engineering Training Corps

^ulcocyte counts were done on 23 soldiers, who were ^{at} Ujina at the time of the bombing and afterward worked in the bombed area. The counts were above 6000 in all but one case, whose count was 4800.

3. Others

a. A soldier, belonging to the 104 Garrison and taking a vacation at th Yaguchi (10km north of the centre) on 6/VIII, returned to Hiroshima soon after the bombing, and worked at Kannonmachi (1.6km south-west of the centre) and at the ruin of the Garrison (0.8 km-1.0km north-east of the centre). From 11/VIII until 13/VIII he complained of anorexia and diarrhea and some petechiae were discovered by ^{the} regimental medical officer on 6/IX. Depilation was not definite. On 24/IX his leucocytes count was 3200 and the erythrocyte count was 4.44m.

b. The blood counts of those soldiers belonging to the 111th Garrison, who were at Okayama on 6/VIII and who worked strenuously at the ruins of the Garrison, from the 9/VIII, were examined on 26/VIII. All showed white counts above 5000 and red counts of more than 3.9m.

c. ^The investigations in 114th Garrison, M.P. 4th Special Guard etc. showed no particular changes. The white counts of 40 M.P.s who came to Hiroshima after the bombing were more than 4800 on 28/VIII.

II Investigation of civilians

1. Investigation in the city of Hiroshima

a. At the clinic of Ujina Hospital the blood of about 20 civilians, who behaved in the bombed area, was examined during 15/IX-30/IX.

None showed any decreases of white count.

b. Mr. Onno, a clerk of the Bank of Japan, came back to Hiroshima on 10/VIII, and worked at the Bank (0.5km east of the centre) he felt some malaise from 25/VIII, and his blood was tested.

Results showed a slight decrease of w.b.c. as follows:

5/XI	w.b.c.	2500
17/IX		3700
26/IX		4700

But no depilation was noted.

2. Mass examination in the neighbourhood of Hiroshima

a. Test method

We investigated the inhabitants of Ishiuchi village, situated about 8km west of Hiroshima city. The inhabitants were all farmers. Between the village and the city lies a hill about 300 meters high. 36 of the inhabitants, who were in the village at the time of the explosion and worked in the city after the explosion to 15/VIII (the outline of their behavior is shown in table 50), were examined Sept. 25, 26, 30, Oct. 1, 2.

Questionnaires ~~were~~ and blood-tests (count of corpuscles, percentage of hb, erythrocyte sedimentation) were utilized.

b. Result (table 50)

As it rained at Ishiuchi village on the day of the explosion, the group was divided in two, the first of which (Group A 25 persons) was not drenched and the second (Group B 11 persons) was caught in the rain.

(I) Count of leucocytes

In general, the counts were in the normal range, and 10 persons had no clinical symptoms. Sedimentation rates of these 10

persons were increased in a relatively large number as shown in table 51. The rates over 30 were 64, 84, and 85 respectively.

Table 51

	0-10	10-20	20-30	30-	total
Group A	2	2	1	3 (1 f 1)	8
" B	1	1	0	0	2
Total	3	3	1	3	10

(2) 8 persons showed slight leucopenia of 5000 or less as shown in table 52

Table 52

	<3000	3000-4000	4000-5000	5000-6000	6000-	total
Group A		2	3	6	13	24
" B	1	1	1	0	8	11
total	1	3	4	6	21	35

The studies were repeated after several to ¹⁰ days in these patients who showed leucocyte counts of 5000 or less. Result are shown in table 53. All showed an increased number of w.b.c. at the second examination.

Table 53

	Name	sex	white count
Group A	Okamoto	m	3800(15/IX) 4300(25/IX)
	Ohshita	m	4600(26/IX) 4600(2/IX)
	Takoi	m	4400(25/IX) 7100(2/IX)
Group B	Miyatomo	m	3600(25/IX) 4500(2/X)
	Yamasaki	m	4900(26/IX) 8100(2/X)

(3) Erythrocyte sedimentation rate (per 60 minutes)

The sedimentation rate was increased in many cases. 11 persons had rates of 30mm or more.

Table 54

	0-10	10-20	20-30	30-	total
Group A	m 2	0	1	5	m 16
	f 2	1	1	4	f 8
Group B	m 5	1	2	1	m 9
	f 1	0	0	1	f 2
Total	12	8	4	11	

Among those whose rates were 50 or more, 3 showed slight leucopenia.

Table 55

Name	Sex	Sedimentation rate	White count
Nakazumi	m	35	2900
Yoshida	f	39	3300
Takai	m	79	4500

(4) 26 persons complained of some clinical symptom, as shown in

Table 56
Table 56
Symptoms

Symptoms	Group A	Group B	Total
Diarrhea	11	8	19
Malaise	10	8	18
Headache & heavy feeling	7	7	14
Lizziness	7	4	11
Anorexia	2	7	9
Fever	1	6	7
Gingival bleeding	1	1	2
Dysphagia	0	3	3
Menstrual abnormality	3	0	3
Tonsillitis	1	2	3
Petechia	1	1	2
Nausea & Vomiting	1	1	2
Abnormal taste	0	2	2
Hematuria	0	1	1
Bloody stool	0	1	1
Decreased potency	0	1	1
Hoarseness	1	0	1

Some patients had several of these symptoms.

Table 57

	Number of symptoms							
	3	4	5	6	7	8	12	total
Group A	2	3	0	0	0	1		6
Group B	0	1	2	1	3	0	1	8
total	2	4	2	1	3	1	2	14

Those caught in rain were affected by more symptoms.

There were 17 ~~patients~~ persons, 12 in Group A and 5 in Group B, who had clinical symptoms, but normal white counts.

There was 1, in Group A, who had leucopenia (w.b.c. 3800) without clinical symptoms.

In short, some inhabitants of Ishiuchi village, who had not been caught in the rain on the day of bombing, & who lived in Hiroshima City after the bombing showed slight leucopenia even after a considerable time. The white counts returned toward normal after a certain period. Moreover some had several radiation-diseaselike symptoms.

Concluding from above mentioned facts, it can be said that many of those, who entered Hiroshima City soon after the explosion, were not damaged from radioactivity of the ground etc., but that some might be influenced by it.

However, we could not find any case, who died of damage, sustained in this way.

INFLUENCE OF SPECIFIC AREA UPON HUMAN BODY

There was a colored shower in the south-west district of Hiroshima City soon after the explosion. According to the story of the local people, fishes in the ponds & earth-worms, up to a certain depth below the surface, died after the shower. Moreover the deposition of fission products was proved there. Therefore the influence of the radioactivity of this district upon the villagers was investigated.

1. Test materials & methods

The place where the investigation was made was Furue, which was 4.5 Km south-west of the center of the bombing and near the site, where radioactivity was maximum.

We could find only 6 villagers, who satisfied our conditions, namely that they were in Furue, at the time of bombing, did not sustain either injury or burn, were caught in the rain, before, & had not been in Hiroshima proper. The investigation was made on Oct. 4.

2. Results

Results are shown in table 58.

One subject had no clinical symptoms & his blood count was normal. But it developed later that he had not been in the rain.

The other 6 persons had some symptoms the most common being malaise, followed by headache & menstrual abnormalities. Some told a story of petechiae & depilation, but these were not actually observed by the investigators, and could not be corroborated. Observed clinical symptoms were as follows:

malaise	6	depilation	1
headache	3	gingiva bleeding	1
menstrual abnormality	3	dizziness	1
anorexia	2	nausea & vomiting	1
diarrhea	1	sore throat	1
fever	1	petechia	1
epistaxis	1	palpitation	1

None had leucopenia, all white counts being above 5000. Some even showed leucocytosis, possibly due to burned noxa.

From the fact, above mentioned, we could not evaluate accurately the colored shower or deposit of fission products upon the human body.

Table 5F

Effect of the shower

At Furue Oct. 4

Name	C.Kawamoto	T.Kagawa	K.Kagawa	E.Imamura	Y.Kimura	E.Aikawa
Sex & Age	m. 61	m. 56	f. 48	f. 35	f. 24	f. 25
Location	Indoor	Outdoor	Indoor	Indoor	Indoor	Outdoor
Behavior after the bombing	for 5 days repair of roof	for 1 week repair of roof	heavy work	heavy work	heavy work	heavy work
Degree of drench	a little	30 minutes	15 minutes	2 hours	2 hours	5 minutes
w.b.c. (moxa)	5800	5100 since 1 week daily 10	11600 since 5 days daily 20	11400 since 1 week daily 16	8600	62500
r.b.c.	408 million	4.92	3.84	4.68	4.74	4.46
Hb(%)	85	75	51	65	76	79
Sedimentation-rate	11	3	12			

RADIOACTIVITY

During the periods between 14/VIII-- 19/VIII, and 29/VIII--11/IX, investigations were made concerning the radioactivity of the ground of the Hiroshima district, the artificial radioactive substances, and the fogging of photographic materials.

1. Test method and Test materials

A Lauitzen electrometer was used, the effective volume of whose ionization chamber is 10 cm^3 . One gram of each test material, spread into 5 cm^2 , was placed 1 cm under the window of the electrometer.

(1) Radioactivity of the ground

The electrometer was placed usually on the bench in inside of an ambulance but sometimes directly on the ground. The strength of γ -ray radiation from the ground was measured chiefly, since absorption of the ambulance floor is nearly equal that of the floor of a Japanese building.

(2) Radioactivity of bones

Radioactivity was investigated of the ashes of bones gathered from the centre area and bone ashes of those in the medical station.

(3) Radioactivity of other materials

The radioactivity of sulphur, gold, silver, tungsten, and other elements was also investigated.

(4) Fogging of photographic materials

Photographic materials gathered from hospitals and photo-shops were tested in regard to fogging by means of developing with Sakura developer at a temperature of 18°C , for 3--4 minutes. (Sakura developer: methol-2g hydrochinon-9g sodium sulphite-75g sodium carbonate-45g potassium bromide-2.5g in 1L).

11 Result of the investigation

(1) Radioactivity of the ground

The radioactivity of the ground originated from two sources, the one, artificial radioactive substances of soil, the other deposited fission products.

a. Radioactivity of bombed area

In the middle of Aug. and in the beginning of Sept. the radioactivity of the ground was measured at the places shown in the fig. 16.

The results were as follows: (table 59)



Fig 16

Place where radioactivity was studied



Table 59.

part 1. (15/VIII--17/VIII)

place studied	strength of radioactivity (time normal)	measured value <u>natural</u> leak
A. Misasa bridge	1	
B. near 1. A. Hospital	1	
C. 40m southwest of Gokokujinja	5	
D. 100m southwest of Gokokujinja	4.2	
E. Entrance of west drill field (on the ground)	5	
F. Kamiyacho	3	
G. 40m west of Yasuda building	3.6	
H. Kokutaiji Gokokujinja	1.6	
I. in front of Red Cross Hospital	1.2	
J. east drill field	1	

part 2. (Beginning of September)

place studied	strength of radioactivity (time normal)
1. Yanagibashi	1
2. Chugoku Press	1.7
3. Fukuya department store	1.5
4. Kamiyacho	2.6
5. Gokokujinja	3.9
6. west telephone office	1.3
7. Temmicho	1



b. Radioactivity of special area

There was a colored shower (brown or black according to the story of the people) about two hours after the explosion in the south-west of Hiroshima. Therefore in the beginning of September radioactivity was measured at the place shown in the ~~app/~~ fig. 17, and the results indicated in table 60.

Table 60.	Strength of Radioactivity measured value natural leak
Studied Places	
a. Koi bridge	1.4
b. Railway cross west side of Koi	2.4
c. Takasu	3
d. Entrance of Ueno Garden at Takasu	3.6
e. Railway cross at Kusatsu	1.9
f. Railway cross at Inokuchi	1.3
g. Itsukaichi	1.
h. Kogoshinkai at Takasu	1.5
i. Kogoshinkai at Furue	2.6
j. Fukuzoji Temple	4.62
k. Hill behind Fukuzoji Temple	5.1
l. Yamada	1.9
m. Kuniari	1
n. Kamimachi at Koi	1
o. 0.5 Km north of Takata	1.8
p. Terada at Yahata village	1

From several places mentioned above, soil was collected & its radioactivity directly measured. The strength of these samples as shown in table 61, was parallel to the strength of radioactivity of the ground at the same time.



Fig 17. Places where radioactivities were studied

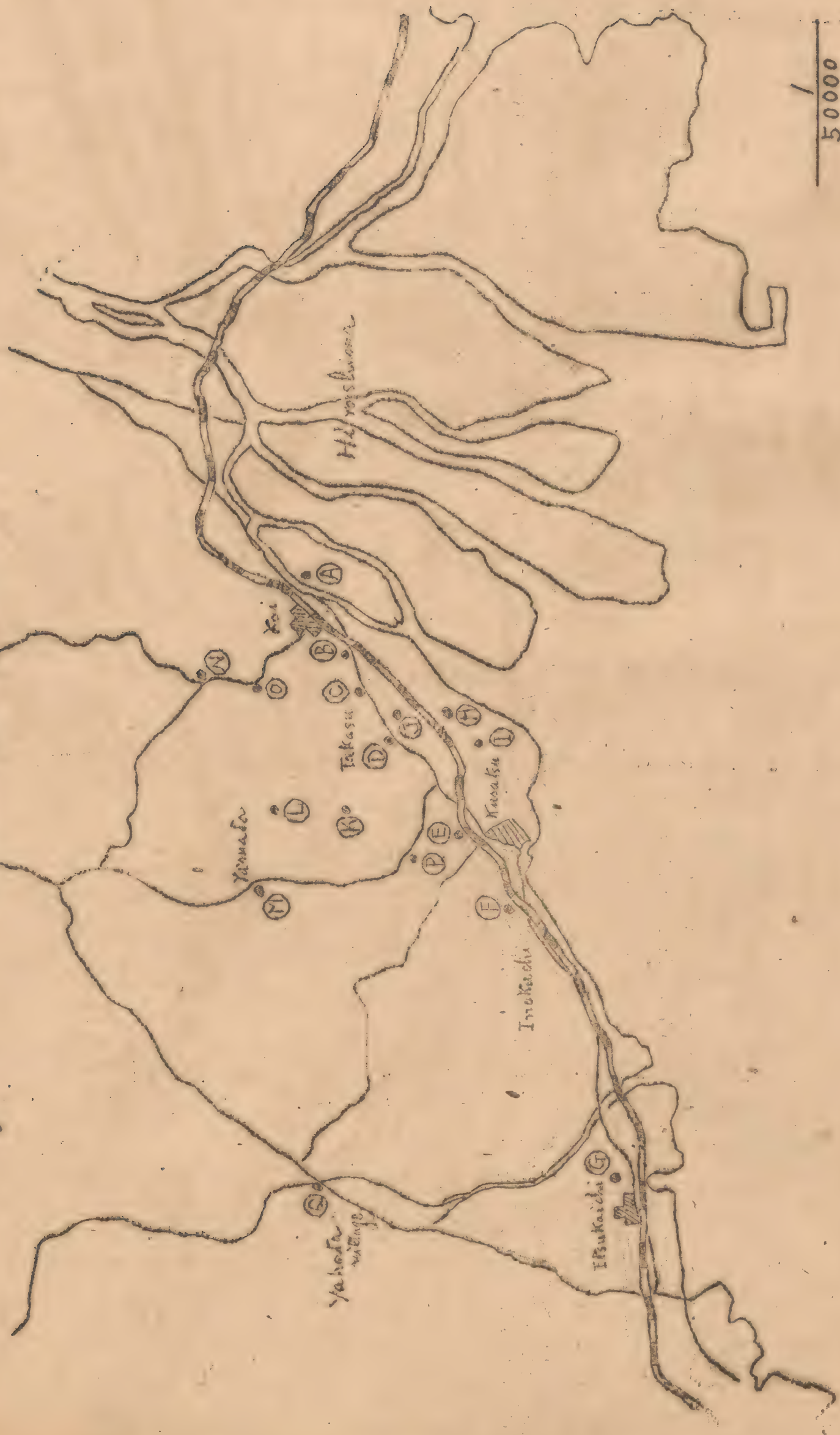


Table 61

Places	Strength of radioactivity measured value / natural leak
1. Yamada	1.2
2. Hill Behind Fukuzoji-temple	3.1
3. Garden of Fukuzoji-temple	4.6
4. Kusatsu	1.2
5. Ueno Garden	4.9
6. Kamimachi at Koi	1
7. 0.5 Km northside of Takata	2.3

Chemical analysis of material gathered from the roof surfaces at Takasu have cleared up the causes of radioactivity: they were Barium, Strontium & rare elements. Since these are not usually contained in ground, they must be fission products. Therefore the radioactivity of this district originated from the deposition of fission products.

(2) Radioactivity of bones.

a) Bones of the dead in the 1st stage

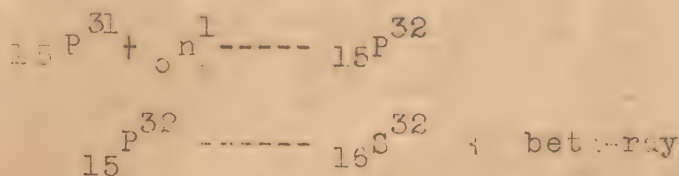
The radioactivity of the bones of patients who died soon after the explosion at the Ninoshima Field Hospital & in 2nd Army Hospital, was investigated. Some of these bones had radioactivity as shown in table 62.

Table 62

Hospital	Date of death	Date of investigation	Weight of bone ashes	Strength of radioactivity
1. Ninoshima	11 / VIII	14 / VIII	2 g.	$\left(\begin{matrix} 10 \\ 10^4 \end{matrix} \right)$
2. 2.A.H.	7 / VIII	16 / VIII	"	$\begin{matrix} 55 \\ (12 \times 10^4) \end{matrix}$
3. "	"	17 / VIII	"	$\begin{matrix} 12 \\ (1.3 \times 10^4) \end{matrix}$
4. Gokokujinja (horse bone)	6 / VIII	16 / VIII	"	$\begin{matrix} 100 \\ (24 \times 10^4) \end{matrix}$

note: including in () - strength of beta-ray per minute per gram at 6 / VIII.

This indicates that phosphorus in bone was changed to radioactive phosphorus by the effect of thermoneutron.



b) Bones of those dying in the 2nd stage

Bones of dead patients who died during the end of Aug. to the beginning of Sept. in Ujina Hospital from typical radiation disease, had radioactivity as shown in table 63.

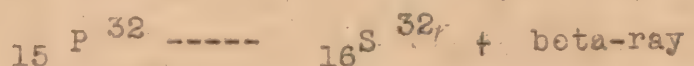
Table 63

Name	Location	Distance from center	Date of death	Date of examination	Strength of radioactivity
Unknown	unknown	unknown	29 / VIII	31 / VIII	0
Iseoka	104 Garrison	1.0 Km	30 / VIII	"	0
Michihara	unknown	unknown	"	1 / IX	1.5×10^3
Satoi	Nakajima p.s.	0.8 Km	31 / VIII	"	3.9×10^2
Chiba	"	"	"	"	1.5×10^3
Shitaku	104 Garrison	1.0 Km	"	"	2.7×10^3
Kitsunai	Nakajima p.s.	0.8 Km	"	"	0
Kawaura	"	"	1 / IX	2 / IX	1.3×10^3
Nagashima	"	"	"	"	0
Murakami	104 Garrison	1.0 Km	"	5 / IX	1.1×10^3
Mochizuki	Nakajima p.s.	0.8 Km	2 / IX	"	6.6×10^2
Ikeda	Noborimachi p.s.	1.0 Km	"	"	3.6×10^3
Fujita	unknown	unknown		"	0
Takahashi	104 Garrison	1.0 Km		"	0
Morita	at home	1.0	1 / IX	"	0

(3) Radioactivity of phosphorus & sulphur

The thermonutron changes phosphorus in bone to ~~radioactive~~ radioactive phosphorus whose half-life is 14 days.

By fast neutron sulphur changes to radioactive phosphorus (half-life 14 days).



Therefore, to know the distribution of fast & slow neutrons, bones & sulphur in insulators were gathered from the bombed area (fig. 18), and their radioactivity was measured. The results are presented in fig. 19.

Fig 18.

Bone & Sulphur Collected Place

Number

Bones

Alphabet

Sulphur



Fig 19-1

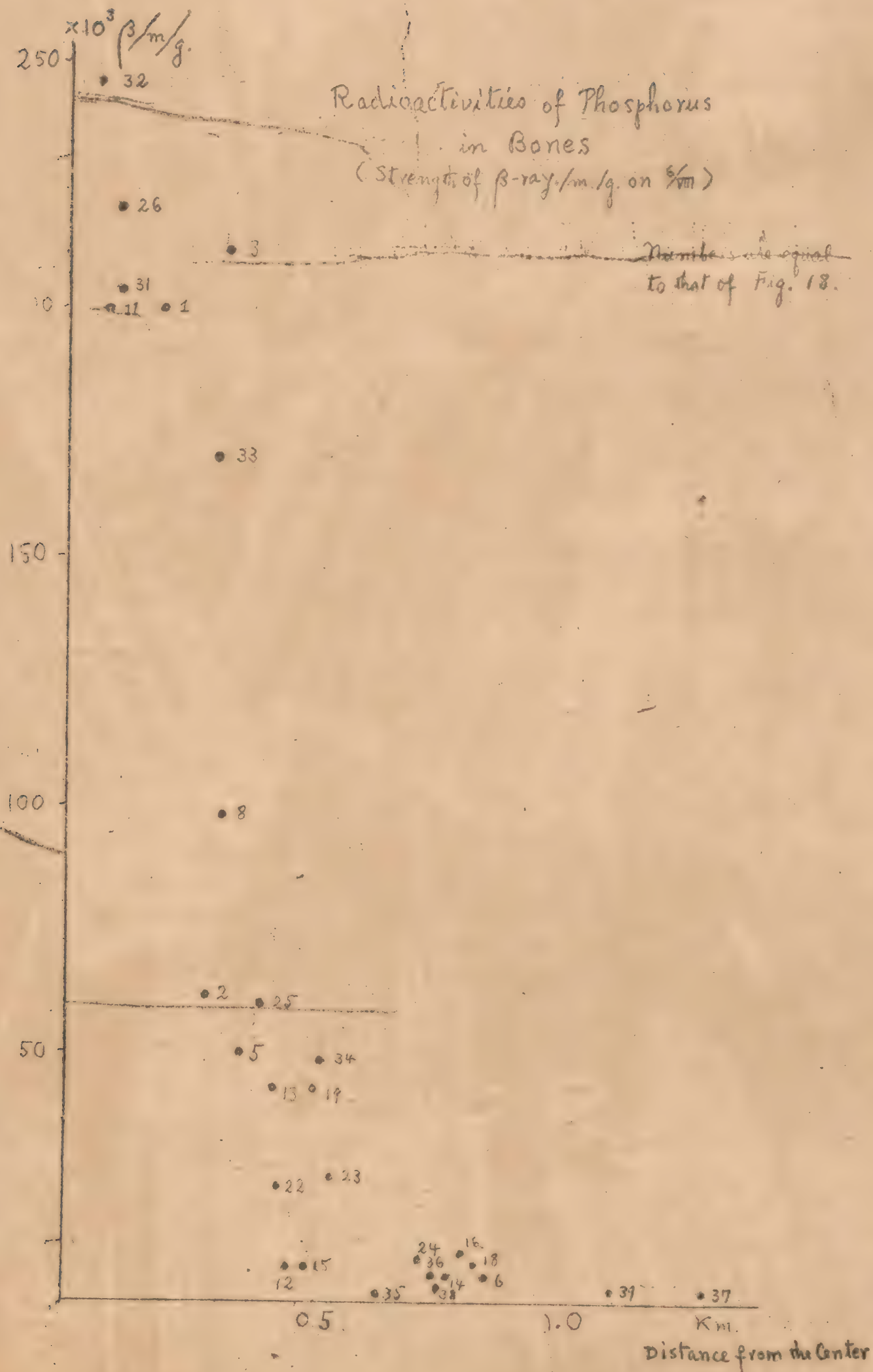
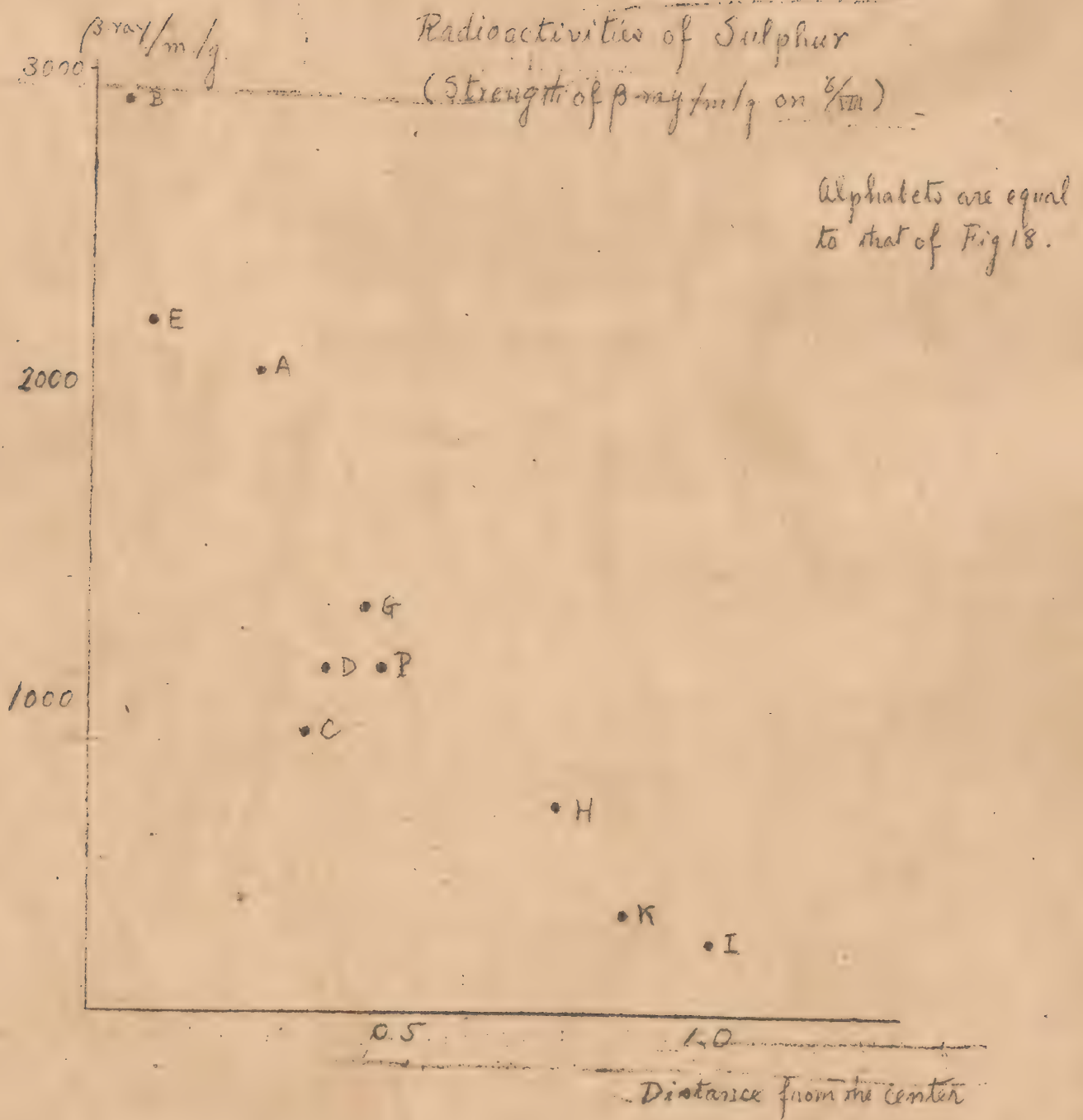


Fig 19-2



(4) Radioactivities of other substances.

- a) Materials taken from Red Cross Hospital (1.5 Km from the center; concrete building)

Gold, platinum, silver, tungsten, ^waluminum, thorium, chlorine, bromine, chromium, arsenic, & antimony were gathered on 15 / VIII. They showed no radioactivity.

- b) Materials taken from 1st Hiroshima Army Hospital (0.5 Km ; japanese building)

Salt & aluminium gave negative result on 16 / VIII.

- c) Materials ^{taken} from 2nd Hiroshima Army Hospital (1.0 Km; japanese building) .

On 16 / VIII only tungsten manifested radioactivity. Aluminium & sodium chloride were negative.

- d) Radioactivity of golden crown of tooth

Within the limitation of our examination, the golden crowns of teeth had no radioactivity.

(5) Fogging of photomaterials

Photographic materials that were collected were more or less fogged as shown in table 64.

We can not without further consideration ascribe the fogging to the radiation as it may result from other physical & chemical causes, but from the fact that the blackness of a film which was between intensifying screens was deeper than the others without intensifying screens, we deduce that the fogging was caused by radiation.

Table 64.

Location	Distance from the center	Method of storing	Kind of photo-graphic materials	Degree of fogging
1. Mitaki Hospital	2.5 Km	in chamber	X-ray film	*
2. Kycsai Hospital	3.0	unknown	"	* (but it likes fogging of an old film)
3. Red Cross Hospital	1.5	in zinced box	"	*
4. "	"	"	"	*
5. "	"	in celler	"	*
6. "	"	in leaded box	"	*
7. "	"	in casette	"	***
8. "	"	in chamber	roll film	*
9. Mitaki Hospital	2.5	"	plate	**
10. Photo-Shop at Yoshijima	3.0	"	"	**
11. Red Cross Hospital	1.5	in zinced box	X-ray paper	*
12. "	"	"	Plinting paper	*

note: each * means one plus

III Consideration of Quantative Data

1. Direct effect of explosion on human body

Human bodies were damaged by neutron & gamma-ray produced directly or indirectly by explosion. Between the two, the later^t is considered to have produced the greater effect & over a wider area.

1) Gamma-ray

The origins of the gamma-rays are supposed to be the following:

- a) The one emitted when slow neutron is absorbed by U_{238} .
(Its energy is in the order mev.)
- b) The one emitted from fission fragments. (Its energy is in the order of $1 / 10$ mev.)
- c) The one emitted when thermoneutron is captured by nitrogen in the air. (Its energy is 2 mev.)

Although it is not yet clear which of these acted most powerfully, the last mentioned is regarded as strongest. Reasoning from the radio-activity of phosphorus in bone the number of thermoneutrons produced by explosion is about 10^{25} . When calculated from the quantity of nitrogen in the air & its cross section, the slow neutron loses $\frac{1}{2}$ of its energy every 140 meter of air layer, and this energy turns to gamma-ray.

Therefore the gamma-ray originates not only the center of the explosion but also everywhere in the path of thermoneutron; so that it extended more widely & further.

The absorbtion coefficient of this gamma-ray by air is 2×10^{-5} . Though the energy of gamma-ray is weakened by absorbtion & scattering of the air, it has a value of 1 - 2 mev on the ground. Distribution of gamma-ray dose is shown in the following table.

Table 65

Distance from the center	r / cm^2
0 m.	18500 r
500	8400 "
1000	2100 "
1500	700 "
2000	280 "

As the energy of this gamma-ray is very high it penetrates human tissue more easily than the usual x-ray. For example, at a depth of 10 cm the dose exceeds 40 % of surface skin dose. Since skin erythem dose is of 1 mev x-ray is 1200 r & epilation dose is 600 r, the deep dose must be relatively large when some changes were observed in skin.

(2) Neutron

Slow neutrons work indirectly on the human body either as the origin of gamma-ray or by inducing the radioactivity of the bones, salt and etc. in the tissue. Fast neutron damages human body directly. The number of the fast neutrons, calculated from the radioactivity of sulphur, is 1 / 100 of thermoneutron -- about 10^{23} . The degree of the absorption of fast neutron in the air is 1 / 3 of the absorption of thermoneutron, & the ionization power of fast neutron is 4 times that of the gamma-ray. The distribution of fast neutron in r-dose is shown in table 66 .

Table 66

Distance from the center	Number of neutron / cm^2	r / cm^2
	0.82×10^{12}	920 r
500	0.33×10^{12}	370 "
1000	0.7×10^{11}	80 "
1500	0.18×10^{11}	20 "
2000	0.6×10^{10}	7 "

note: explosion center assumed at 560 meter above ground

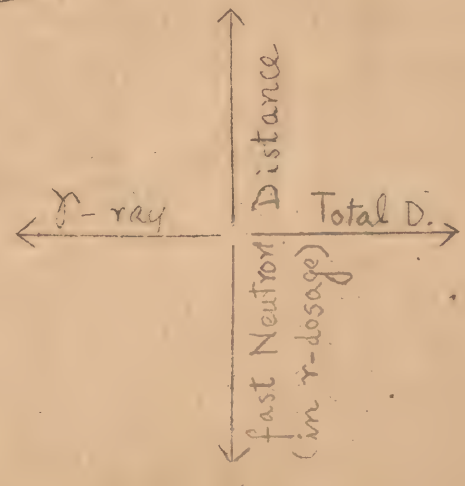
Though the biological effects of neutron is 2 - 5 times stronger than gamma-ray according to the sensitivity of the different kind of cells, the fast neutron was less effective in damaging the human body on account of its smaller magnitude & narrower sphere of distribution.

(3) The distribution of total dosage of fast neutron & gamma-ray is calculated as indicated in fig. 20. In the central area human bodies were damaged by the direct effect of fast neutron & gamma-ray and the indirect effect of thermoneutron. As the distance from the center increases the effects of the fast neutron & thermoneutron decrease and only gamma-ray remains.

Fig 20 Distribution of Dosage



Area where was proved radioactivity of bone corresponding more than 1.3×10^4 rads/m.g.



What is the cause of the radiation disease?

From the fact that there is proved radioactivity corresponding more than 1.3×10^4 beta-ray / min. / gram in some of the bones of early dead cases & in the bones collected within 0.7 Km of the center, it seems that these patients were effected by gamma-ray & neutron directly or indirectly. Assuming that the dose of x-ray sufficient to hurt the bone marrow is 0.1 r this is comparable to 1.5×10^4 beta-ray / min. / gram. The patients who died later are regarded as damaged only directly by gamma-ray & neutron, because even in the bones of dead cases the radioactivity was always below a dangerous level.

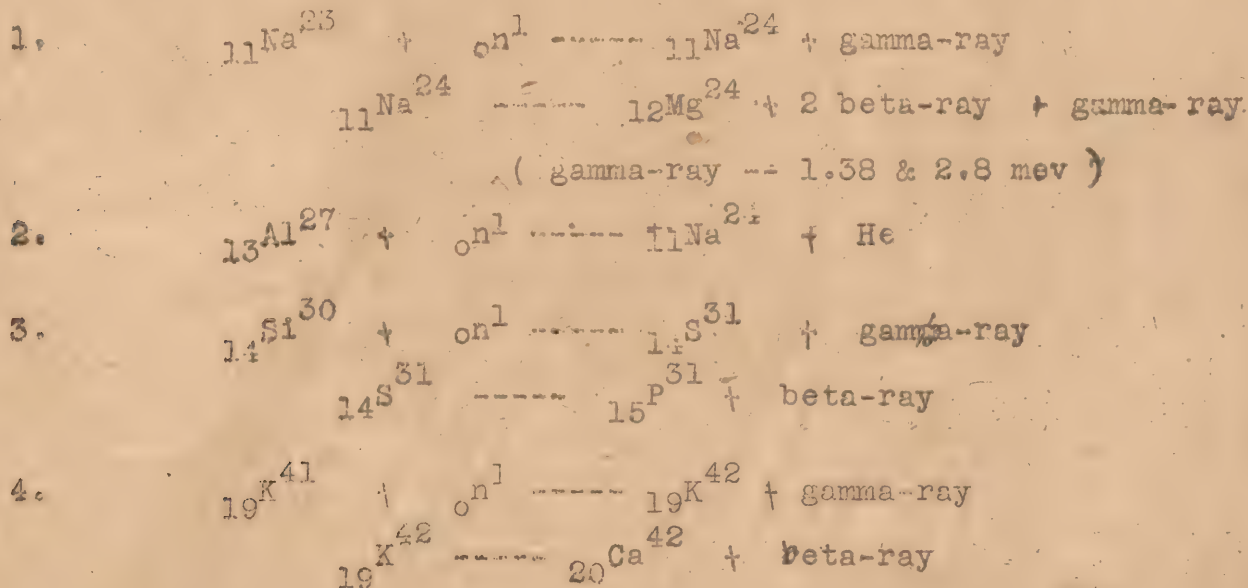
Since epilation was observed within 1.3 Km of the center the dosage at that distance might be about 600 r reasoning from the biological stand point. The explanation of why this dose is smaller than that calculated in fig.20 is probably on account of the influence of absorption by buildings.

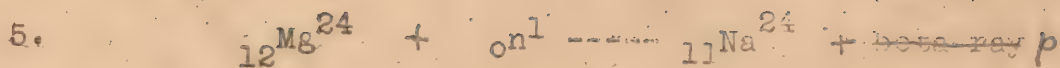
2. Effect of radiation from ground on human body

Assuming that the ground of Hiroshima is formed mainly of granite, then its composition is as follows:

SiO_2	61.7 %	
Al_2O_3	15.5 %	(Al 8.0 %)
MgO	3.9 %	
Na_2O	3.5 %	(Na 2.4 %)
K_2O	3.3 %	(K 0.15 %)

When neutron works on these elements they turn to radioactive substances.





They emit gamma- & beta-ray and their half-lives (see table.67.) are very short.

Table 67

Element	Half-life
Na^{24}	15.5 hour
Si^{34}	157. minutes
K^{42}	12.4 hour

If these reactions happened in the upper 10 cm layer of the ground, the total quantity of gamma-ray emitted from the ground near the center area might have reached more than 500 r 1 or 2 days after the bombing. Therefore, people who worked in the center area for a long time immediately after the explosion might suffer some damage.

The radioactivities of these elements decayed very quickly, and even in the middle of Augst the quantity of gamma-ray emitted from the ground was not enough to damage human body.

The measurement indicated only 10 times background, and 200 times background would correspond to 0.1 r which would be necessary to produce some change in human tissue.

(As regard to the further studies see the Report of the Institute for Physical Chemical Research.)

DISCUSSION

In observing radiation disease there are several points to be considered.

- 1) As stated in foregoing chapters, the strength of neutron and γ -ray which were causes of human injuries, observed from the view point of distance from the foot of explosion centre, do not follow ^{ex}actly the inverse square law of distance. It is further impossible to draw the regular isodosage curves, as in a strict sense dosages are dissimilar at a certain distance, because of differences of defensive power of substances above the ground. Only some assumptions may be made as to the similarity of the dosage at a specific distance.
- 2) The irregularity of these appearance of all symptoms due to the existence and individual differences of an incubation period before neutron and γ -ray effects became manifest. All effects ^{were} the result of causes operation at the time of bombing on Aug. 6.
- 3) The effects of γ -ray are strong within the range of direct penetration neutrons. There are also the γ -ray effects outside this range. The symptoms by both are the same.
- 4) In general, since the whole body had been simultaneously irradiated not only certain organ, but all organs may manifest dysfunction.
- 5) γ -rays being shorter wavelength, their penetrating power is great, deep dosage are relating great in comparison to skin surface dosage. For example, in case 1 million volts the dosage at a depth of 10 cm to more than 40% of the skin surface dosage. Dosage ^{amount} causing damage to the skin and its appendages was very great. (For example, 600r epilation dosage by 1 million volts).
- 6) Among the cells, most sensitive are the young, primitive types and cells with high metabolic rates. Differentiated cells show low sensitivity.
- 7) Greatly damaged cells die, and other gradually recover. Some die at cell division, and other ^{giantic forms} result from abnormal divisions.
- 8) Individual sensitivity for neutron and γ -rays differs according to the ⁱⁿternal and external circumstances of each individual. Taking the foregoing facts as a basis, radiation disease may be explained as the symptom originating from partial or complete destruction of the physiological functions of existences. We shall discuss some of our clinical and clino-pathological observation.

1. White blood corpuscles

In these patients affected ^{by} considerable dosage, showing striking symptoms during the 1st stage, not only ~~in~~ these cells present in the ~~present~~ hematopoietic organ but these of the peripheral blood stream must have been destroyed. The ~~cause~~ ^{course} of most of these cases being not more than 10 days, it is regrettable that very few were carefully examined. Sublieutnant Yanagi at Eba Hospital reported, patients with high fever and dysenterylike diarrhea who in the 1st stage had only 300-400 white b.c. in the peripheral blood. This is inexplicable without postulating disturbances of the white b.c. in the peripheral, regardless of how short their life span may be. Disturbance of leucopoietic function alone is inadequate explanation. In the 2nd stage, it was characteristic to find a rather rapid decrease of white b.c., which generally preceded the fever.

Although a few may have been due to infection, most were due to the reaction of cells affected at the time of bombing becoming manifest at this stage. That is: within the 10-15 days of the so-called incubation, the bone marrow was keeping pace with the destruction of white b.c. in the peripheral blood through its remaining functions. But with the decrease of the old w.b.c. and the ^{function of the} supplementary marrow being insufficient, the w.b.c. count in peripheral blood began to show rapid decline. Observing the course of this decrease, it is certain that the number of the ^w b.c. had not been low from the onset. In the 3rd stage the survivors with slighter affection of leucopoietic function are gradually recovering and some of them also presented additional symptoms of infection. In the 1st and 2nd stages, there must have existed cases of infection due to various organisms ^{mus}. The symptoms of infection may have been masked by the dominant radiation disease. As the types of w.b.c. and their mother cells differ in sensitivity to neutron and γ -ray effect, they present characteristic blood picture at different periods of the disease.

Not only does the sensitivity of mother cells differ ^{or each} but their recovery of regenerative function and the life cell type in the peripheral blood is of importance. The state of w.b.c. in peripheral blood must be carefully discussed.

In cases of extreme decrease of w.b.c. in the blood stream, as few as 10 cells might be found on a blood smear making a differential count little value.

Due to the abnormality of cell division, giant forms of neutrophiles resulted. In the convalescent stage the appearance of a shift to the left & young forms of w.b.c. etc, indicated active & adequate regeneration.

Myeloblast were found only in exceptional instances. As a whole, it can be stated that there was no great disturbance in the supply of w.b.c. from the bonemarrow to the blood stream.

Concerning the other granular cells, eosinophiles reacted promptly, & striking reactive eosinophilia was ~~indicated~~ noted in the convalescent stage, similar to the reaction in certain infection diseases.

Lymphatic tissue & lymphocytes are extremely sensitive cells to neutron & X-rays, but there were few cases of marked decrease of lymphocytes as compared to that of neutrophile. Many cases rather showed a relative lymphocytosis. It is very strange even in 2nd stage to find pathologically little regeneration of the lymphatic tissue.

Monocyte levels are comparatively well even in the earlier stages maintained. There is little loss, which fact due to the strong resistance of these cells.

Plasmacells were found relatively often in the peripheral blood in 2nd stage, which finding agrees with the picture in the bonemarrow.

2. Red blood corpuscles

Since r.b.c. in the peripheral blood stream, are cells of great resistance, & their life in the blood stream is the largest, there was no apparent decrease in the early stage.

The return to normal of r.b.c. in the convalescent stage being late compared to that of w.b.c. reflects the retarded recovery of erythroblasts in the bonemarrow. The reduction of reticulocytes in the peripheral blood in 2nd stage indicated that the count of r.b.c. was maintained mainly by old erythrocytes, without supplements from the bonemarrow after the exposure.

Judging from the morphological change of spleen, it is easy to imagine the disturbance of its function. How this resulted in changing the fate of r.b.c. in peripheral blood remains to be explained.

We found no hemoglobinurics, from which fact it is certain that hemolysis did not take place in the blood stream.

3. Hemorrhage

Platelets showed such degrees of reduction as to be the cause of hemorrhage, & the stage in which the bleeding level was reacted, may be learned from the first clinical appearances of hemorrhage. This was usually after the 3rd week. The resistance of platelets to neutron & γ -rays is very great, & excluding fatal cases any remarkable decrease in the earlier stage is highly improbable.

We believe the appearance of thrombocytopenia in the 2nd stage to be the result of the gradual exhaustion of platelets in the peripheral blood & the absence of regeneration within bonemarrow. From above mentioned can be explained the fact, that in milder cases, that is those affected by comparatively smaller dosages, the tendency to bleed appeared later. ~~However~~ Hemorrhage also failed to occur in the early stage & there were even cases who died in the 1st stage without its occurrence. As the endothelial cells of the capillaries have a strong sensitivity, the possibility of hemorrhage due to blood vessel disturbance can not be denied. But it would seem that this factor is of slight importance, since the Rumpel-Leede phenomenon was usually negative. There are no data from which to judge whether deficient production of thrombokinese, or deficiency of vitamin K & P have acted as factors.

4. Epilation

Depilation is due to damage of the hair follicle cells.

5. Nausea. Vomiting

Nausea directly after the bombing is similar to roentgen sickness. Those of 2nd stage, can be understood as a reaction to gastrointestinal diarrheas. Anorexia may be considered similar to nausea & the pitiable state of the surroundings & the food supply not being at all helpful. Its prominence in this disease may be explained as another phenomenon of roentgensickness.

6. Diarrhea

Through the whole course of the disease, there was a high incidence of diarrhea. Diarrhea in fact was characteristic. Severe cases on that very ~~at~~ evening of the bombing began to liquid or mucoid bloody stools. Bacteriological tests being negative, there was no question of dysentery. Drinking of filthy water or sewage to quench the terrific thirst failed to explain all the cases. During the phase of

hemorrhage, bloody stools might be attributed to it in part. At this stage, the intestines showed morphological changes of high degree & it seems reasonable that these must be one of the significant causes. In the 1st stage bloody stools may be considered the result of irritation from the destruction of lymphatic tissue & degeneration of the mucous membrane etc...

7. Fever

In each stage rise of temperature may be due to the various causes. At an early period of the first stage, such rise may be due to heat burn, dehydration (especially owing to inadequate supply of drinking water), loss of blood. Infection too (of burn or wound) may have to be thought of as a cause.

In the 2nd stage, irritation from breakdown products of protein resulting from tissue destruction, interference with sweating, & damage to the central heat regulating mechanism, must be considered. In cases showing wide swings of temperature with positive blood cultures, fever must be due to infection, but continuous fevers showing no reaction to antipyretic drugs are probably related to other causes.

It is difficult to know the cause of fever in each case, but judging from the fact that most cases have gone through a specific course, dysfunction of the central heat regulating mechanism induced by breakdown products of protein would seem to be the most appropriate assumption.

In conclusion, radiation disease can be said to present a most complicated symptom-complex by virtue of differences of the internal & external modifying circumstances. It is not possible to summarize the disease completely, but we may attempt to do so by defining it; as the symptoms originating from partial or complete destruction of the physiological functions which maintain life.

Appendix

THE CIRCUMSTANCES AT THE TIME OF EXPLOSION

1. The condition before the explosion

Hiroshima was in the process of scattering the citizens & the buildings because of the danger of air-raids. It was said to have a population of about 240,000 at the end of July.

On the day of bombing, many soldiers, civilians & students in labor services were working outdoors at wrecking buildings to create fire-breaks. Those in labor services had come from distant places, and the Army Corps & Guards on special services in the city were many. This was the reason why an unreasonable large number of casualties occurred in relation to the constant population.

An air-raid alarm and warning signal was given on 21.18 of Aug. 5 & the alert continued to 00.10 of Aug. 6. The warning signal sounded again at 07.30 of Aug. 6, & the all-clear signal at 08.10. People started to work on hearing this signal. It was therefore just before the next signal sounded that they were struck by the atomic bomb.

2. The state at the time of bombing

Soon after the all-clear signal sounded (the watchman of the Training Engineering Corps discovered at 0806, and ascertained it at 0809), three planes, B-29s (some said there were only one or two planes) were seen flying westward from north-east of Hiroshima at a height of about 8,500 meters, dropping three parachutes (which was proved subsequently not to be radiosondes) and one bomb. As soon as the bomb was dropped, the planes turned to the left & departed (no record was made of the falling sound of the bomb). A moment after the rotation of the B-29 plane at about 08.15, there appeared a magnesium-flashlike type of light & simultaneously a white smoke curled high into the sky.

1) The flash

It had been reported variously that the flash of light was magnesium-like blue-white, or white colored like an arc-lamp light, or yellowish red. In general many people in the City proper considered it yellowish red, while those at a distant place said it was blue-white.

The flash was seen even at Saijo (30 Km east-north of Hiroshima).

2) Heat

People outdoors felt heat on the skin at the time the flash broke out. Some said that they felt it 2 or 3 seconds after the flash of light.

3) Blast

The people near the center of explosion were not sure about the relation of the flash & the blast, because they were thrown to the ground by the falling house or the pressure of the blast. At a distance, they seemed to be beaten by the wind a short time later the flash was felt. No precise record was available of the time relations of flash and the development of heat.

4) Explosive sound

The people in the City apparently heard no clear explosive sound, while those on the distance did heard it. It was not however a very loud one.

5) White smoke

After the flash of light appeared the white smoke rose in the sky. The next figure shows what a painter in Kure observed.

6) Rain

It was reported from the Eba meteorological station that it thundered between 10,02 & 10,40, 10,52 & 11,09. It rained pretty hard from about 11,00 for 30 minutes to 2 hours in the different localities at the midway of Temmachi & Dobashi in the east, in the neighbourhood of Gion in the north, in a part of Ishiuchi village in the west & in the neighbourhood of Kusatsu in the south-west. The color of rain was yellow or black. The zone the rain fell were some complicated, Missabashi which is situated eastward from Dobashi, & a part of Yasumura in the north were both visited by the rain.

7) Others

Some said that an order of Ozone rose up at the time of explosion. Though the fire seemed to occur partially by means of the flash of light (some reports were made of the fire starting simultaneously with the flash), many it may be thought, broke out secondarily.

The people in the City lost consciousness or were so stupefied ^{with} wonder by the destruction of the buildings & the other sights, that many might be supposed not to be sure of their observations.

However most of them said that their vision was darkened, or that they saw something like a fire-ball flying or a shooting star.

Pool & pond

Many fish were floating dead in the pools & ponds.

Appendix

Weather-Chart on Augst 6.

(from Eba Meteorological Station)

Hour	Direction of wind	Velocity of wind (m / s)	Temperature (C)	Humidity	Air-Pressure (+ 700 mm Hg
1	NNL	2.0	25.0	88	62.0
2	"	2.0	24.7	90	62.1
3	"	1.5	24.2	92	62.1
4	"	2.5	23.9	93	62.5
5	"	2.3	23.7	93	62.7
6	"	2.3	23.6	94	63.1
7	"	1.3	24.7	89	63.5
8	N	0.8	26.7	80	63.6
9	S L	1.7	27.3	79	63.5
10	"	2.5	29.3	67	63.9
11	W	2.8	30.0	65	63.3
12	SSW	3.3	30.7	64	62.5
13	S W	3.7	31.7	64	62.1
14	"	3.2	31.0	66	61.9
15	"	3.8	30.3	70	61.5
16	"	4.0	30.7	65	61.4
17	"	5.5	29.7	72	61.3
18	"	5.2	28.3	78	61.6
19	SSW	3.0	28.2	77	62.1
20	SSE	5.2	27.5	83	62.3
21	S	3.7	26.9	79	63.0
22	"	2.3	26.7	78	62.9
23	S W	1.5	26.6	78	63.0
24	WSW	2.5	26.5	75	62.7

Note: After the bombing Cumulo-nimbus rose & it was
a thunder-shower.

Fig. 1

Range of damage

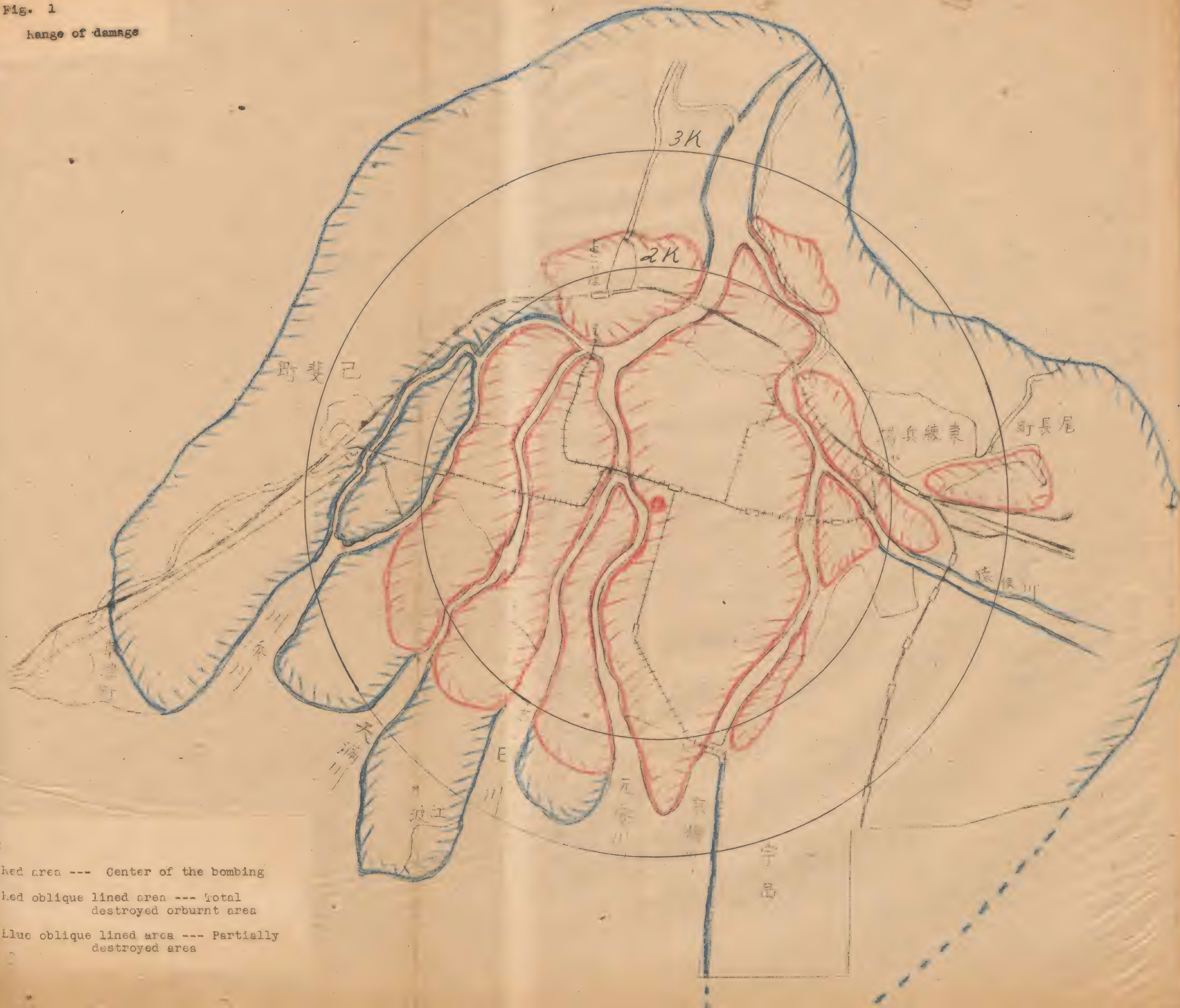


Table 1

Effects of atomic bomb
upon students group

District	Distance from the centre	Behavior	Total	Death	Unknown	Severely wounded	Slightly wounded	Noncommu- nicated	Survived
District belonging to the Motokawa primary school	0.5	Within or -out School buildings or at the private primary schools and partly at home	192	192					
District belonging to the Fukuromachi primary school	0.8	" " "	?	3*	20*				8*
District belonging to the Noboricho primary school	1.0	" " "	?	?	?	?	?	?	?
District belonging to the Otemachi primary school	1.0	" " "	430	35	16			166	213
Pupils in labour at Dobashi district	0.9	Working out-of-door (Helping for the evacuation) Motokawa higher primary school 1st prefectural Middle school (III Class)	80 54	80 54					
Pupils in labour at Kamicho district	0.8- 1.1	Working out-of-door (Helping for the evacuation) Sutoku Middle school (III Class) 1st prefectural girls' school (I class)	150 230	50 230	100				
Pupils in labour at Zaimokuchō district	0.7- 0.9	Working out-of-door (Helping for the evacuation) Municipal girls' school (I & II class)	600	580					20
Pupils in labour at the eastern end of Shinjishiro	0.8	Working out-of-door (Helping for the evacuation) 2nd prefectural Middle school (I class)	560	560					
Pupils in labour at the northern part of Hachobori district	0.7- 1.0	Working out-of-door (Helping for the evacuation) Sutoku Middle school (I & II class)	500	500					
1st prefectural Middle school	1.0	Within and -out	165	161					4
1st prefectural Girls school	0.8	" "	74	7					

Pupils in labour at the power distributions office	0.4	Helping for operations III primary school (II. higher class boys)	8	5	3			
Pupils in labour at Kōamichō	0.8-1.1	Working out-of-door (Helping for the evacuation) Municipal Middle school (I & II class)	491	158	170	35		134
Total (within 1 Km)			3340	2479	229	35	166	371
District belonging to the Nakajima primary school	1.2	Within or-out school buildings or at the private primary Schools and partly at home	608	1	236			305 72
District belonging to the Temachō primary school	1.3	" " "	764	232	10			305 217
District belonging to the Hakujiima primary school	1.3	" " "	603	43				489 71
District belonging to the Hirose primary school	1.2	" " "	312	52	39	79		168
District belonging to the Takeya primary school	1.3	" " "	503	76	48	80		104
District belonging to the Kannon primary school	1.3		7421	8	9			544 860
Pupils in labour at Fujimitchi	1.3	Working out-of-door (Helping for the evacuation) III Primary school (Higher class boys)	132	50	32	19		31
Pupils in labour at Kakomachi	1.0-1.5	Helping for operations (indoor) II Municipal Girls school	50	13	2	5		30

Pupils in labour at Zakobamachi	1.0-1.5	Working out-of-door (Helping for the evacuation) II Prefectural Girls school (II Class) III Primary school (Higher class girls)	43	36	2	4		1 39
Pupils in labour at Sentei	1.1-1.3	Working out-of-door I Prefectural Girls school	80		80			

Attached Middle school of the Higher Normal school	1.5	Within and without the school- building	40	7			33	
Pupils in labour at the Prefectural printing office	1.1	Helping for operation II Primary school	11	9	2			
Pupils in labour at Kokutaiji-Machi	1.1	Working out-of-door (Helping for the evacuation) I Prefectural Middle school (I class)	150	150				
Total (within 1.0-1.5 km)			4683	543	481 150	240	1643	1626
District belonging to the Kanzaki Primary school	1.6	Within or -out school buildings or at the private primary schools and partly at home	211	63			77	71
District belonging to the Senda Primary school	1.9	" " "	247	31	22		75	119
District belonging to the Danbara Primary school	1.9	" " "	441	20			191	230
Pupils in labour at the western part of Hijiyama & Tsurumi- bashi	1.7	Working out-of-door (Helping for evacuation) I Prefectural Middle school (III class)	70			70		
Pupils in labour at Hijiyama-bashi	1.7	Working out-of-door (Helping for evacuation) I Primary school (I class)	175	108		67		
Pupils in labour near Sendamachi Primary school	1.7	Walking on the street Attached Middle school of H.N.S (Ist class)	27	5				22
Pupils in labour at Sumino- Factory in Yokogawa	1.5	Helping for operations (in-door) II Municipal girls school	50			6		44
Pupils in labour in front of Hiroshima Railway station	1.8	Helping for the post-office business (in-door) I Primary school	39			25		14
Total (within 1.5-2.0 km)			1260	227	22	168	343	500
District belonging to the Misasa Primary school	2.1	Within or-out school-buildings or at the private primary schools and partly at home	817	15	5	448	349	



District belonging to the Funairi Primary school	2.1	" " "	184	3		35		146
District belonging to the Kojin Primary school	2.2	" " "	148	7	5	73		63
District belonging to the Ushida Primary school	2.3	" " "	393	21				372
District belonging to the Ôshiba primary school	2.5	" " "	763	13	2			355 333
District belonging to the Minami-cho Primary school	2.8	" " "	339	14	1	98		226
District belonging to the Hijiyama Primary school	2.9	" " "	1142	3	1			128 1010
II Prefectural Middle school	2.1	Within and -out of the school-building	10	2				8
Eastern Drill-ground	20- 25	Helping for evacuation (out-of-door) II. Prefectural Middle school (II. class) I. Prefectural Girls school (I. class)	360 130	10 1		350 64		65
Hiroshima Monozoly Bureau	2.6	Helping for operations (in-door) II. Prefectural Girls school (I. class)	105	1		5		97
Hiroshima Printing Company at Kanmon-cho	2.1	Helping for operations (in-door) I. Prefectural Girls school (II 2. III class)	730					230
Asahi Weapon Factory at Minami-Kanmon-cho	2.5	Helping for operations (in-door) I. Prefectural Middle school (IV class)	200					200
Kannon Branch Factory of Taiwa Heavy Industrial Fact	2.5	Helping for operations (in-door) II. Primary school	43	3				89
Printing Office of the Government railway at Ôsuguchi	2.6	Helping for operations (in-door) I. Primary school	41			15		26
Storage of the Government rail- way at Ôsuguchi	2.6	" " "	44			5		39
San-sei Seiyaku at Wishi Kaniya-cho	2.6	" " "	65					65

Hiroshima Gas Works	2.2	Helping for operations' (in-door) III. Primary school	15			5		10
Hirose Factory (Deshio-chô)	2.8	Helping for operations' (in-door) I. Primary school	42	3		15		24
Hiroshima Higher school	2.8	Within and-out	70			10		50
Total (within 2.0-3.0 km)			5121	96	14	1123	832	3056
District belonging to the Ujina Primary school	3.1	Within or-out school-building or at home	188					488
District belonging to the Kohi Primary school	3.1	" " "	696	9				687
District belonging to the Yaga Primary school	3.9	" " "	200					200
The First Primary school	3.0	Within or-out	2	1				1
II Prefectural girls' school	3.3	" " "	170			23		107
III. Primary school	3.3	" " "	14			1		13
Shinko-Kinzoku Factory at Ôsumachi	3.3- 4.0	Helping for operations' (in-door) III. Primary school	15					15
Shôwa-zôki (Ôsumachi)	"	" " " I. Primary school	43			2		41
Kumakura Factory (Ujina)	"	" " " III Primary school	16			1		15
Kudama Iron Factory at Ôsumachi	"	" " " I Primary school	42					42
Hiroshima kô-kû at Kohi	3.1	" " " I. Prefectural Middle school (II class) 150 I Prefectural girls' school (II & III class) 188						150 188
Kansai Kosakujô at Eba	3.2	" " " I. Prefectural Middle school (III. class) 50	50	1				49
Mitsubishi Zôki (Kannonchô)	3.0- 3.5	" " " Sutoku Middle school (II. class)	200					200
Army Clothing Department	3.0	" " " Attached Middle school of the H.N.S	80			10		70
Total (within 3.0-4.0 km)			2314	11		34	3	2266

upon troops under Chugoku H.Q.

[illegible]

Table 5
Damage to the auditory organs

Name age, sex	Place	Distance from the centre(km.)	Condition	Location of wound	Name of wounds	Complaint	W.	C.	AL.	FS4.	Local state
Itomu Omoto 26, f.	Minamicho 3-chome	2	within sitting left front	head & face	contusion & laceration	left deafness	left	18	12	10	Obsolete perforation of the upper back part of the left tympanic membrane with a slight general redness
Tmayo Nishida 53, f.	In front of Shiragamicho	0.7	within sitting right	ear-lapp & neck	contusion	right deafness	left	20	12	11	1/2mm big perforation of the lower front part of the right tympanic membrane with a clot
Tsumio Nakada 37/32, m.	Behind the city-hall	1.2	without standing right front	face, chest & upper extremities	2nd&3rd degree burn	right deafness	right	18	-	10	moderate redness of the right tympanic membrane
Shigeo Nakada 25, m.	H.Q. of the military police	0.8	within sitting left back	head, neck & upper extremities	2nd degree burn	left tintus	W				Slight redness of the left tympanic membrane
Zensaku Nakazawa 43, m.	Garr.104	1.0	within sitting left	head, chest & upper extremities	2nd degree burn	left deafness	left	22		3	moderate redness of the left tympanic membrane
Chosuke Mukai 55, m.	Otemachi 5-chome	1.4	without standing front	head & chest	3rd degree burn	right deafness	right	24		14	Impossible to examine
Fumie Fukagushi 20, f.	Sendamachi	2	within standing right back	face & upper extremities	contusion & 1st degree burn	tintus & right deafness	right	27	11	16	Triangular rupture of the lower front part of the right tympanic membrane with slight redness
Chisati Nageyama 29, f.	Hiranomachi	2	within standing right	head & chest	contusion & 2nd degree burn	right deafness	W	24	10	10	Miliary triangular ruptures of the lower back part of the right tympanic membrane
Sakae Kato 57, f.	Hiranomachi	2	within standing left	face & upper extremities	2nd degree burn	giddness & left deafness	left	22	9	9	moderate redness of the right tympanic membrane
Zenzyu Morinaka 57, m.	Near Sumivo- shibashi	1.6	without standing right back	right half of the face, neck & right forearm	3rd degree burn	right deafness	right	24		6	moderate redness of the right tympanic membrane
Shoto Okamoto 17, m.	Eba(otagawa)	3.5	without standing left back	left half of the face, back & left forearm	3rd degree burn	left deafness	W	12		13	moderate redness of the left tympanic membrane
Seiichi Yamamura 54, m.	Sendamachi 2-chome	1.2	within sitting right front	face, chest & upper extremities	3rd degree burn	right deafness	W	7	9	10	Triangular rupture of the lower front part of the right tympanic membrane
Ayako Yamamura 27, f.	Garr.142 Zakobamachi	1.5	without standing left front	face, chest & upper extremities	3rd degree burn	left deafness	left	18			Impossible to examine
Hideo Kimura 28, m.	Garr.42	?	without standing left front	chest, face & upper extremities	3rd degree burn	left deafness	left	12		10	1/2mm big rupture of the lower front part of the left tympanic membrane
Hiroshi Nusumoto 36, f/m.	Garr.104	1.0	without standing front	face, chest & upper extremities	3rd degree burn	left deafness	left	8		4	moderate redness of the left tympanic membrane
Ziro Nusumoto 28, m.	Garr.104	1.0	within standing front	face, chest & upper extremities	3rd degree burn	right deafness	right	8		5	moderate redness of the right tympanic membrane
Sachiko Okubo 17, f.	Minami- masuvacho	2	within sitting left back	face, chest & upper extremities	3rd degree burn	left deafness	W	24	8	14	Miliary ruptures of the lower back part of the left tympanic membrane
Akio Shigeta 33, m.	Garr.104	1.0	within sitting back	neck, back & upper extremities	3rd degree burn 2nd	right deafness	right	10	10	7	Miliary ruptures of the lower front part of the right tympanic membrane with moderate redness
Shizuko Fujivoshi 17, f.	Minami- masuvacho	2	without standing front	face, chest & upper extremities	3rd degree burn	left deafness	left	22	16	11	moderate redness of the left tympanic membrane
Higashimura 32, m.	Tengincho	1.5	without standing			left deafness	right				Perforation of the upper back part of the left tympanic membrane with hyperaemia
Akimoto 32, m.	Nippon Bank	0.5	within sitting			deafness	right	14		6	Perforation of the lower front part of the left tympanic membrane with coagula
Onishi 42, m.	Muramotacho	0.7	within sitting								

Fig. 7.

Appearance of Tumor symptoms

(228 dead, 287 survivors)

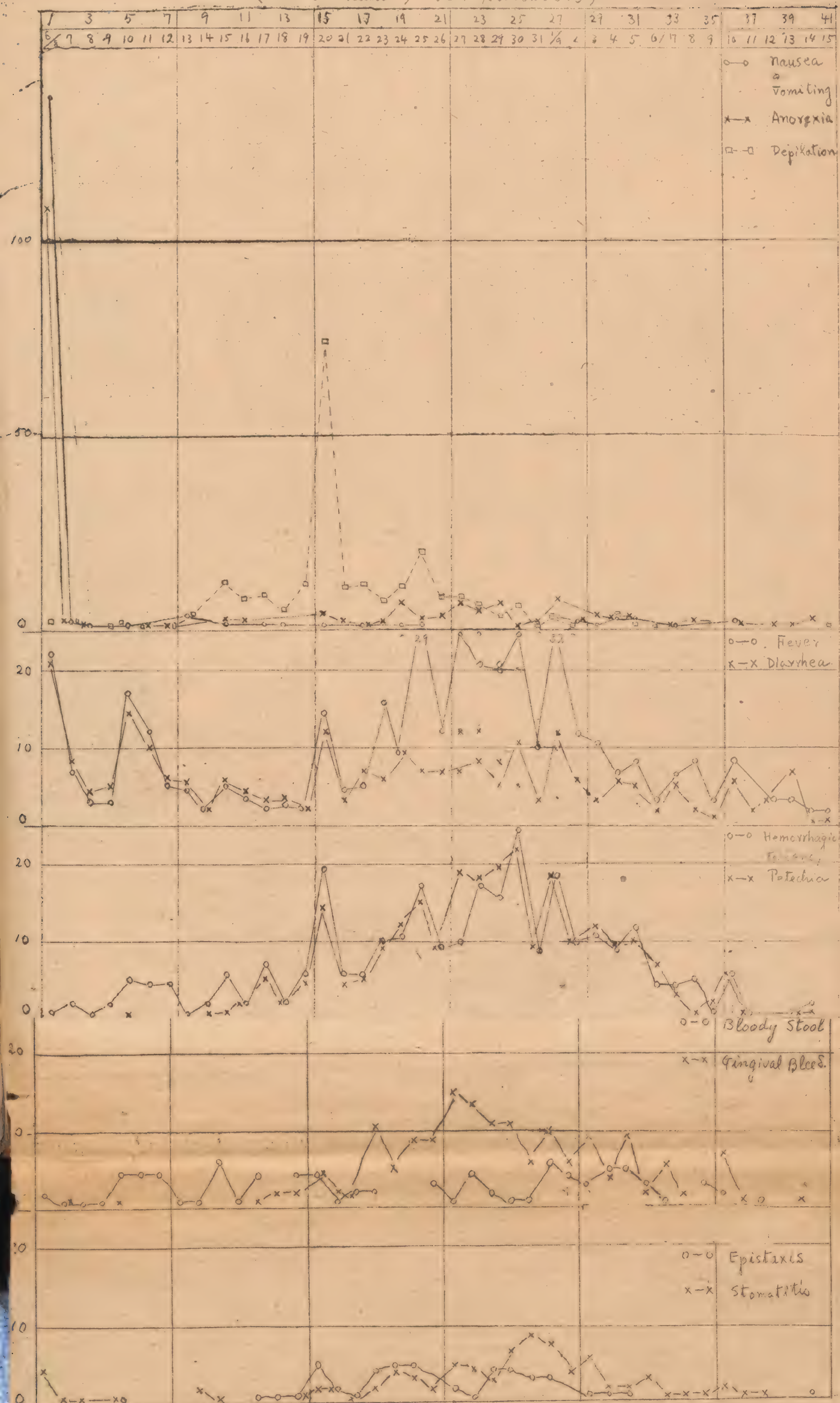




Table 12

Blood Picture in 2nd Stage (Sept. 3 -- 10)
(by Dr. Nakao)

Name	Age & Sex	Date	Hb (%)	R.b.c. (million)	Color index	W.B.C.	Reticu- locyte (permil.)	Platelets (thous- and)	Sedimentation- rate (per 60 min.)	Count- ed Cells	Differential Count										Plasma cell	Nucleated r.b.c.	Turk- form	Myclo- blast	Megaka- ryocyte		
											Lym.	Mon.	Myel.	meta- myel.	Band	Segm.	Eos.	Bas.									
Morita	21 f.	3/1X	51	2.12	1.21	250		1.0	1.24	25	20	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Takahashi	30 m.	"	82	3.87	1.06	2450				50	31	1	2	0	3	1	0	0	1	0	0	0	0	0	0	0	
Moriseko	27 m.	"	50	2.09	1.2	900		29.9		50	36	1	0	0	2	9	2	0	0	6	7						
		5/1X	35	1.58	1.12	200		15.8	165	50	26	4	0	0	3	17	0	0	0	0	0	0	0	0	0	0	
Horiuchi	33 m.	3/1X	64	2.67	1.2	600				16	11	5	0	0	0	0	0	0	0	0	4						
																			0	2							
Tanabe	m.	"	86	3.86	1.13	44	0	7.72		6	6	0	0	0	0	0	0	0	0	0	0						
Hashimoto	m.	"	40	2.08	1.0	1900			10.4	20	11	2	0	0	0	2	0	0	0	0	0						
Sasaki	25 m.	4/1X	72	3.27	1.1	400	0			2	1	0	0	0	0	0	0	0	0	0	5						
Sueoka	m.	"	64	2.6	1.23	700		13.0	140	25	15	2	1	2	0	5	0	0	0	0	0		1				
		8/1X				3600			(5/1X)										0	0							
Wakatsuki	m.	4/1X	68	2.53	1.36	600	2			50	32	4	0	0	1	12	0	0	0	0	0						
Okuda	28 m.	"	90	4.15	1.08	1200	3	12.45	27	10	1	1	1	0	4	3	0	0	0	0	1						
		8/1X				2200			(5/1X)										0	0							
Okita	25 m.	4/1X	68	2.6	1.3	900	4	5.2	108	50	49	1	0	0	0	0	0	0	0	0	0						
		8/1X				1400			(5/1X)										0	0							
Motoyama	m.	5/1X	61	2.62	1.16	300	1	5.24		25	20	1	0	0	0	4	0	0	0	0	0						
Nakamura	m.	"	55	2.79	1.0	2100		36.27		50	24	11	0	3	0	12	0	0	0	0	0						
Araki	m.	"	58	2.32	1.26	700	0	23.2	97	50	37	3	0	0	2	2	0	0	0	0	0						
		7/1X	70	2.88	1.22	155	0	23.0	(5/1X)										0	0							
Shimohara	m.	5/1X	56	2.88	0.98	900			108	50	14	6	0	1	2	24	0	0	0	0	1		5				
		8/1X				2800			(5/1X)	100	21	12	0	2	11	54	0	0	0	2	1						
		9/1X				3600																					
Hata	m.	5/1X	70	3.66	0.95	1800		29.2	70	100	14	0	0	14	14	52	0	0	0	0	0						
		8/1X				6400			(5/1X)	100	22	0	3	9	18	48	0	0	0	0	0						
Kaneko	m.	5/1X	50	2.22	1.35	1700			34	50	11	6	0	1	4	27	0	0	0	0	0						
		9/1X	66	3.0	1.2	3300	44	57.0	(5/1X)	100	22	11	2	2	3	58	0	0	0	0	0						
Itagaki	m.	5/1X	58	1.92	1.51	2000				50	3	0	3	16	11	15	2	0	0	1	1						
		8/1X				4000		48.0		150	40	10	1	4	16	59	20	0	0	0	0						
Sugino	m.	5/1X	42	1.87	1.13	1000			60	100	31	13	3	2	13	35	3	0	0	0	0						
		8/1X				2900			(5/1X)	100	20	12	3	6	9	48	1	0	0	0	0						
Ohuchi	24 m.	5/1X	54	2.95	0.91	1400		14.7	60	100	14	4	1	6	20	55	0	0	0	0	3						
									(5/1X)										0	0							
Yasui	m.	"	56	3.05	0.91	1300		3.5	100	50	9	0	0	0	24	15	0	0	0	0	0						
		8/1X				4900			(5/1X)										0	0							
Okamura	24 m.	5/1X	38	3.79	0.5	1200		162.9	140	100	8	6	0	0	15	70	0	0	0	0	0						
		8/1X				6200			(5/1X)										0	1							
Kurihara	22 m.	5/1X	70	3.41	1.0	1500	2	5/	128	25	16	1	0	0	2	6	0	0	0	0	0						
									(5/1X)	100	11	2	0	0	7	80	0	0	0	0	0						
									135										0	0							
									(5/1X)										0	0							
Wada	24 m.	5/1X	45	2.01	1.02	1000		44.2											0	0							
Katsutani	22 m.	"	68	3.02	1.13	180			115	80	5	0	0	3	35	29	0	0	0	2	6						
									(5/1X)										0	0							
Kuruma><																											

Table 13

Blood picture in End St. (Prof. Morita & Maj. Takata)

Name	Date	Distance from the center	Hb (%)	r.b.c.	Red Blood Corpuscles				Polychromasia	Jolly body	Cabot ring	Nucleated r.b.c.	Platelets (10,000)	w.b.c.	Differential				Count of w.b.c.			Lymphocyte big	Lymphocyte small	Plasma cell	Sedimentation-rate
					reticulo-cyte (%)	Anisocytosis	Poikilocytosis	Basophilic							Neutrophil	Myelocyte	Metamyelocyte	Band form	Segm. form	Eosinophile	Basophile				
Miyake	20/IX	0.7 Km	30	1.35	-	-	-	-	-	-	-	-	8	2400	-	-	18.0	55.0	0.5	-	6.0	4.0	13.5	0.5	140
	23/IX		25	1.36	5.0	**	*	-	*	-	-	* 3	7	1900	-	2.0	21.5	42.5	0.5	-	9.0	1.0	23.0	0.5	
Nagasaki	20/IX	0.8	69	3.21	-	*	-	-	-	-	-	-	22	4000	-	-	12.0	38.0	1.0	-	7.0	20.0	22.0	-	38
	26/IX		54	3.22	3.3	*	*	-	-	-	-	* 2	31	5300	-	2.0	3.5	52.5	6.5	1.0	10.0	18.0	5.5	1.0	
Okuda	19/IX	1.0	56	3.29	-	*	-	-	-	-	-	-	7	1700	-	-	14.0	35.5	2.5	-	13.5	11.0	23.5	-	105
	24/IX		56	3.49	2.7	*	-	-	-	-	-	-	26	4100	-	-	7.0	53.0	3.0	-	17.0	7.0	13.0	-	
Okita	19/IX	1.0	52	2.6	-	*	*	-	*	-	-	* 1	20	2800	1.5	1.5	21.0	26.0	1.0	-	9.5	10.5	22.5	6.0	32
	27/IX		51	2.79	3.9	**	*	-	*	-	-	-	26	4600	-	-	3.5	69.5	-	-	9.5	3.0	14.5	-	
Nakamura	19/IX	1.0	46	2.17	-	*	-	-	*	-	-	-	48	3500	-	-	28.0	41.5	-	-	9.5	7.5	13.0	-	102
	24/IX		46	2.24	2.4	**	-	-	*	-	-	-	27	2900	-	0.5	7.5	50.5	1.0	-	10.5	5.0	24.0	1.0	
Murakami	19/IX	1.0	60	2.91	-	*	-	-	*	-	-	-	16	3600	-	-	9.0	40.0	0.5	-	12.5	5.5	31.5	-	37
	24/IX		54	2.81	3.5	**	*	-	*	-	-	-	18	1700	-	-	4.5	30.5	12.0	0.5	13.0	34.5	5.0	-	
Ikeda	19/IX	1.0	51	3.26	-	*	-	-	*	-	-	-	20	5600	-	-	22.5	37.5	1.0	-	16.0	9.0	10.0	-	78
	24/IX		51	2.65	4.3	**	*	-	-	-	-	-	10	7900	1.5	1.5	7.5	44.0	9.0	-	16.0	9.0	10.0	-	
Ishii	19/IX	1.0	39	1.57	-	*	-	-	*	-	-	-	7.5	4500	-	1.5	23.5	39.5	0.5	0.5	13.5	3.5	17.5	-	95
	24/IX		39	2.04	6.9	**	*	*	*	-	-	* 1	27	5200	-	0.5	13.5	64.0	-	0.5	7.0	8.5	5.0	1.0	
Okamura	19/IX	1.0	44	1.61	-	*	-	-	-	-	-	-	21	4000	-	-	26.0	57.5	-	-	4.5	2.5	9.5	0.5	82
	24/IX		44	2.2	3.7	*	-	-	-	-	-	-	35	5400	-	-	13.0	72.0	0.5	0.5	4.5	5.5	4.0	-	
Kamakura	19/IX	1.0	43	2.6	-	*	-	-	-	-	-	-	10	2300	-	1.0	23.0	41.0	-	-	9.0	6.5	17.5	2.0	149
	25/IX		43	2.6	2.5	**	**	-	*	-	-	-	44	3200	-	0.5	6.5	59.0	-	0.5	11.0	9.5	13.0	-	
Kuruma	21/IX	0.8	50	3.42	-	*	-	-	-	-	-	-	14	12100	-	-	15.0	63.5	4.5	-	10.0	2.5	4.5	-	123
	27/IX		48	2.92	2.2	**	**	-	*	-	-	-	31	6700	0.5	0.5	3.5	63.5	19.5	0.5	7.0	2.5	3.5	-	
Miyamoto	20/IX	1.0	72	3.18	-	*	-	-	-	-	-	-	10	3600	-	-	13.5	24.5	1.0	-	8.5	11.5	41.0	-	55
	25/IX		60	2.91	2.8	**	*	-	-	-	-	-	28	3100	-	1.0	12.0	37.0	2.0	0.5	14.0	24.0	9.5	-	
Nomura	24/IX	1.1	42	2.07	-	-	-	-	-	-	-	-	-	3700	-	-	-	-	-	-	-	-	-	-	155
	25/IX		43	2.27	2.9	**	*	-	*	-	-	-	31	1700	-	-	17.5	55.0	-	-	9.0	4.5	13.5	0.5	
Hosokawa	21/IX	1.0	58	2.40	-	*	-	-	*	-	-	-	40	2900	-	-	21.0	51.0	-	-	6.0	5.0	17.0	-	104
	25/IX		47	2.59	4.5	**	*	-	-	-	-	-	28	5800	0.5	-	9.0	75.5	-	-	8.5	5.5	1.0	-	
Kusaka	21/IX	0.8	65	2.69	-	*	-	-	-	-	-	-	1.5	2700	-	0.5	23.5	36.5	-	-	11.5	10.5	19.5	-	86
	25/IX		56	3.0	5.3	*	-	-	-	-	-	-	1.3	3800	-	-	12.0	55.0	-	0.5	15.5	14.5	2.5	-	
Muneoka	20/IX	1.2	81	4.71	-	*	-	-	-	-	-	-	14	6000	-	0.5	17.0	47.0	-	-	10.0	10.0	15.5	-	27
	26/IX		65	3.82	3.3	**	*	-	-	-	-	-	34	9200	-	-	6.5	67.5	0.5	-	11.5	12.0	2.0	0.5	
Sakurai	21/IX	1.0	69	3.39	-	*	-	-	*	-	-	-	5	5400	-	0.5	24.5	32.5	2.5	-	7.5	0.5	24.0	-	100
	26/IX		59	3.61	2.3	*	*	-	-	-	-	-	30	9500	-	-	10.5	51.5	-	-	15.5	14.5	8.0	-	
Nishimoto	21/IX	1.0	68	3.75	-	*	*	-	*	-	-	-	23	4600	-	-	17.5	45.0	1.0	-	12.0	12.5	11.5	1.0	40
	26/IX		51	2.64	3.5	*	*	-	-	-	-	-	10	5300	0.5	0.5	15.5	43.5	0.5	-	10.5	25.5	3.5	-	
Kunimoto	21/IX	0.8	68	3.75	-	*	-	-	*	-	-	-	15	4500	-	0.5	22.5	46.5	1.0	-	3.0	7.0	18.0	1.5	44
	26/IX		55	3.21	4.9	*	*	-	-	-	-	-	25	3500	-	-	1.0	51.5	0.5	0.5	10.5	16.0	10.0	-	
Wada	21/IX	1.0	67	3.18	-	*	*	-	*	-	-	-	11	4000	-	-	17.0	49.5	3.5	-	9.5	9.0	11.5	-	27
	27/IX		57	3.1	2.8	*	*	-	-	-	-	-	13	6500	-	-	11.5	63.0	3.0	1.0	6.0	14.0	1.5	-	
Utsunomiya	21/IX	1.0	63	3.38	-	*	-	-	*	-	-	-	26	7200	-	-	9.0	37.0	1.5	-	13.0	8.5	30.5	1.0	113
	27/IX		42	2.43	2.6	**	*	*	*	-	-	-	-	8900	-	-	10.0	38.5	10.0	-	10.5	20.5	10.5	-	

note: each * means one plus & - means plus minus.

Table 17

Bone Marrow Puncture in 2nd Stage
(By dr. Nakao)

(Sept. 3 -- 10)

Name	Age & Sex	Date	Cell- Count	Cou- nted Cells	Differential Count (percentage)										Basophile	Lympho- cyte	Türk- f.	Monocyte	Erythroblast			Reticulo- cyte	Plasma- cell	Megakaryo- cyte
					Myelocyte			Metamyel.	Band- f.	Seg- f.	Eosino- phile		Baso.	Polych.					Orth.					
					A	B	C				young	mat.												
Morita	21 f.	3/1X	1.125	100 0	1	0	0	1	0	1	0	0	0	80 (8)	0	4	1	2	0	0	2	0		
Takahashi	30 m.	"	13.400	100 0	0	0	0	4	2	11	0	0	0	46	0	2	-	2	4	20	3	6		
Moriseko	33 m.	"	1.700	100 3	1	0	2	2	5	20	0	2	-	38	0	0	5	1	1	9	5	1		
Horiuchi	-- m.	"	2.850	100 0	0	0	0	2	0	0	2	2	0	53	0	0	12	0	3	10	16	0		
Sasaki	25 m.	4/1X	3.500	50 0	0	0	0	0	0	3	0	0	0	5	0	0	0	0	0	42	0	0		
Sueoka	-- m.	"	6.000	100 0	1	2	7	7	0	2	0	3	-	66	0	11	0	0	3	3	2	0		
Wakutsuki	-- m.	"	1.600																					
Okada	28 m.	"	2.000	200 0	0.5	1.0	1.3	5.5	0	10	2	11	0	36	1	2.5	6.5	9.5	12.5	0.5	0.5	0		
Okita	25 m.	"	4.000	109 0	0	0	0	5	0	0	0	5	0	80	0	1	0	4	5	5	4	0		
Motoyama	-- m.	"	1.400	35 0	0	0	0	0	0	2	0	1	0	28	0	0	0	1	3	cells in mitosis		1		
Araki	-- m.	7/1X	1.000	25 0	0	0	0	3	0	0	0	0	0	11	0	0	1	0	0	4	6	0		
		6/1X	4.000	100 -	-	2	-	18	-	26	-	-	-	26	0	5	1	8	6	8	0	-		
Simohara	-- m.	9/1X	87.200	100 5.3	4	9.3	1.3	1.3	16.0	33.00	0	0	0	12	0	2.7	5.3	5.3	1.3	2.7	0	-		
Hata	-- m.	-	3.200	100 1	6	6	9	20	15	8	0	0	0	6	2	8	4	4	1	7	0	3		
		7/1X	33.000	200 1	3	13.5	6.5	9.5	15.5	20	0	0	0	2.50		2.5	6.5	7.5	2.5	6.5	1.5	0.5		
Kaneko	-- m.	9/1X	25.200	250 0	1.6	6	2	7.2	18.4	32.80	0	0	0	0.4	4.40	0.4	7.2	11.2	3.2	4.0	0.8	0.4		
Itagaki	-- m.	6/1X	16.000	200 2	1	3.5	12	23.5	14.5	0.50	0	0	-	7	0.5	1	13.5	7.0	0	3.0	2.0	0		
Sugino	-- m.	8/1X	1.200	100 1	2	0	13	10	13	21	0	0	0	27	0	2	0	2	1	6	0	2		
Ohuehi	24 m.	7/1X	7.800	100 0	1	0	3	8	9	45	0	1	7	19 (7)	0	3	1	7	2	0	1	0		
Okamura	24 m.	-	4.500	100 0	1	0	3	0	0	45	0	1	-	19 (7)	0	3	1	7	2	0	1	0		
Kurihara	22 m.	-	1.800	37 0	0	1	0	0	0	2	0	0	0	34	0	0	0	0	0	0	0	0		
Utsunomiya	44 m.	-	24.000	200 1	5.5	3.5	3	15.5	17.5	20	0	1.5	0	0	0	0	5.5	12.5	10	3	1.5	1		
Wada	24 m.	-	7.500	100 2	1	2	6	15	16	10	0	0	0	8 (4)	0	2	6	12	16	0	4	0		
Katsutani	23 m.	-	3.500	25 0	1	0	0	3	0	1	0	0	0	8 (1)	0	0	0	4	6	2	0	0		
Kuruma	-- m.	-	9.350	200 1	0	0	6	0	9	0	0	0	0	0	0	0	0	1	4	3	5	0		
Sumimoto	26 m.	-	3.500	200 2.5	13	18.5	2.5	3.5	8	8.50	0	0	-	10	-	6.5	5	9.5	2	7	2	2.5		
Tsumashige	21 m.	-	14.400	200 0.5	1.5	1.5	1	1	6	30	0	5	0	26	0	2	5	3	0	1.5	14	0.5		
Kunimoto	-- m.	-	3.800	100 0	0	0	0	12	0	6	0	0	0	69 (4)	0	3	1	0	0	7	2	0		
Akagi	28 m.	-	14.400	250 3.2	6.4	10.4	28.8	19.6	2.8	3.60	0.4	0	0	10.40		1.2	1.2	4.3	5.2	0.4	1.2	0.4		
Okada	22 m.	-	27.250	250 0	4	20	4	6.4	16	18	0	1.2	0	6.8	0	0	6	7.6	0	1.2	2.4	0		
Nishihara	24 f.	7/1X	8.600	200 0.5	0	0	20	22.5	0	1.50	0	0	0	20	1.5	0	2	8.5	14.5	2	6.5	0		
Tanimoto	34 f.	"	-	50 0	0	0	0	0	0	2	0	0	-	12	0	0	1	5	16	10	3	1		
Takada	22 m.	-	9.600	225 0	1	12.9	4.9	5.2	20	34.20	0	0	0.4	8.80	0	0	0	5.3	5.3	0.4	0	0.4		
Inoue	26 m.	-	18.200	250 0.4	0.4	8.8	6.8	11.6	16.8	10.40	0.8	0	1.2	19.20		1.2	2.4	4	16.4	0.4	2	+		
Mitsune	55 m.	-	1.200	100 0	0	0	0	0	1	6	1	0	0	53	9	0	0	0	0	6	23	1		
Kusaka	32 m.	-	62.000	333 0.6	1.5	0.6	7.2	11	27.3	13.20	0	0	0	9.1	0	0	0.9	3.6	8.1	7.5	1.2	2.1	0	

number included in () -- young-form
of lymphocyte

Table 18

Bone Marrow Puncture in 3rd Stage (23 - 27 / IX)
(By Prof. Morita)

Differential Count of Nucleated Cells (per millage)

Name	Date	Count of nucleated cells	Nucleated r.b.c.	Myeloblast	Promyelocyte	Neutrophiles				Eosin. w.b.c.	Baso. w.b.c.	Monocyte	Lymphocyt.	Megakaryo.	Plasma + Re- ticulum cell.	Reticulocyte %
						Myelocyte	Metamy- elocyte	Band p.	Segm. f.							
Miyake	23	17800	258	4	28	70	156	266	74	18	2	48	62	+	16	72
Okuda	27	24200	308	10	20	40	148	210	112	32	0	44	70	+	6	50
Nakanura	24	12400	138	8	28	100	154	230	208	0	0	26	82	+	16	37
Ishii	24	59600	362	8	8	36	108	250	128	8	0	38	38	2	4	119
Murakami	24	16600	4	12	28	94	130	244	92	182	6	44	154	+	10	
Ikeda	24	78200	220	8	22	94	188	196	114	54	0	36	54	+	14	49
Nomura	25	23200	272	48	34	78	186	140	82	2	0	50	70	+	30	29
Kanakura	25	53400	214	38	30	80	126	234	116	12	2	14	96	+	36	31
Okamura	24	131000	238	12	20	58	198	240	142	26	0	26	32	2	6	70
Hosokawa	25	87000	356	26	26	34	82	156	144	30	0	76	52	+	8	57
Kusaka	25	60400	298	48	20	24	110	192	150	38	0	56	54	+	10	53
Nagasaki	26	39400	276	46	54	102	114	128	88	58	4	26	78	6	20	36
Munaka	26	129600	142	26	34	108	190	224	172	8	2	24	50	+	10	77
Sakurai	26	175800	222	26	28	82	168	220	96	20	2	58	68	+	8	35
Nishimoto	26	16200	158	18	20	50	146	272	152	12	2	62	98	+	10	46
Wada	26	62800	216	30	32	46	112	224	156	72	0	24	80	+	8	38
Utunomiya	27	212000	200	14	12	44	136	202	84	144	0	26	112	+	28	35
Kuruma	27	71400	124	6	6	56	168	224	272	66	2	50	24	+	2	35
Okita	27	21600	366	10	10	26	160	172	138	16	0	34	66	+	2	57

Table 30

Laboratory data of patients in 2nd stage

Name	Distance from the center	Admission Date	Date of death	Fever	Pulse	Respiratory	Appetite	Nausea & Vomiting	Gingivitis	Stomatitis	Petechia	Epistaxis	Hematuria	Bloody stool	Diarrhea watery bloody frequency (daily)	Depilation	Others	Sedimentation rate g	Blood Examination					Bacterium Culture						
																			Date	Hb (%)	r.b.c. (million)	r.b.c. (million)	Bleeding time	Coagulation time	Resistance of r.b.c.	Stool Salmonella	Dysentery	Blood		
Tanaka	1.0 Km	30 / VIII	4 / IX	40.5 C	100	15 - 25			moderate	mild	severe				severe	mild														
Sato	1.0	28 / VIII	31 / VIII	40	80 - 110	20 - 38	no food	-	mild	"	"	-	-			severe	Apathy	85 (28/VIII)		T	29/VIII	45	333	2.11	28'	11' - 34'30" (2/IX)		-	-	-
Takano	0.8	28 / VIII	5 / IX	37.5 - 40	70 - 100	20 - 25	"	-	-	"	mild	-	-		mild	"	Visual disturbance	105 (28/VIII)			3/IX	45	45	2.5			-	-	-	
Kikuchi	1.0	28 / VIII	/ IX	37.5 - 40.2	70 - 120	20 - 25	"	-	severe	severe	moderate	-	yes			"		110 (28/VIII)			28/VIII	40	436	2.58	12'	5' - 14' (2/IX)	0.38 - 0.32 (30/VIII)	-	-	-
Terita(f)	1.0	27 / VIII	1 / IX	39.7	40.5	40 - 100	25 - 32	"	-	mild	moderate	-	-		yes (no diarrhea)	moderate	Delirium	134 (28/VIII)			28/VIII	62	300	2.83	15'		0.38 - 0.28 (31/VIII)	-	-	-
Iwada	1.3	27 / VIII	1 / IX	39.8	80 - 120	20 - 27	"	yes	moderate	severe	mild	-	-		mild	5	Dyspnea	57 (27/VIII)			28/VIII	45	230	2.3	18'			-	-	-
Nagashima	1.0	28 / VIII	1 / IX	39	80 - 130	20 - 27	"	-	severe	"	"	-	yes		severe	moderate	6	Delirium			28/VIII	64	400	3.39			0.35 - 0.32 (31/VIII)	-	-	-
Matsumoto	1.0	30 / VIII	5 / IX	39.5 - 39.8	70 - 100	25 - 30	"	yes	-	mild	moderate	severe	-		mild	-	Convulsion	20 (31/VIII)			31/VIII	60	25	2.14				-	-	-
Shitaku(f)	0.9	31 / VIII	3 / IX	37.5 - 39.8	90 - 100	20	good	"	moderate	"	"	-	-		mild	5 - 6	Panperitonitis				31/VIII	65	2200	2.4	5'30" - 25'30" (2/IX)			-	-	-
Ohmura	1.0	28 / VIII	1 / IX	40	90 - 110	25 - 35	no food	"	severe	severe	severe	-	-		severe	12	Dyspnea				29/VIII	52	300	2.51	30'			-	-	bac. coli
Ishida	0.8	27 / VIII	2 / IX	40.5	80 - 120	17 - 20	"	-	mild	moderate	"	mild	-		severe	-					28/VIII	50	300	2.4			0.40 - 0.32 (31/VIII)	-	-	Streptococcus hemolyticus
Iwai	1.0	26 / VIII	29 / VIII	39.5	90 - 100	24 - 40	"	-	severe	severe	"	"	-		mild	"	Liver 1 f. palpable	81 (27/VIII)			31/VIII	35	300	1.0				-	-	-
Waseko	1.0	28 / VIII	6 / IX	39.5 - 40.3	75 - 110	20 - 26	good	-	"	mild	"	-	yes			mild					27/VIII	85	44	3.98				-	-	Streptococcus viridans
Shintaku	1.0	28 / VIII	31/VIII	39.5 - 40	90 - 130	20 - 30	no food	-	"		moderate	-	-		mild	-					29/VIII	60	1100	2.27	10'30" - 23'30" (2/IX)	0.42 - 0.32 (31/VIII)		-	-	-
																severe					29/VIII	35	300	2.36				-	-	-



Laboratory data of patients in 3rd stage

Name of patients	Distance from the center	Sedimentation rate of r. b. c.	Hb.	r. b. c.	Colour index	Reticulocyte %	Red blood Cells						Platelets	w. b. c.	
							Anisocytosis	Poikilocytosis	Polychromasia	Stippling	Jelly coat body ring	metabates r. b. c.			
Yake (38♂)	0.7 _{km}	140 (20/IX)	30(20/IX) 25(23/IX)	490 136	1.11	50	-	-	-	-	-	-	8	2400	
							++	+	+	-	-	-	+3	7	1900
Nagasaki (26♂)	0.8	38 (30/IX)	67(20/IX) 54(26/IX)	321 322	1.07	33	+	-	+	-	-	-	22	4000	
							+	±	+	-	-	-	31	5300	
Okuda (28♂)	1.0	105 (19/IX)	56(19/IX) 345	329 345	0.85	27	+	-	-	-	-	-	7	1700	
							+	-	-	-	-	-	26	4100	
Okita (25♂)	1.0	32(19/IX)	52(19/IX) 51(29/IX)	260 279	1.00	39	+	+	+	-	-	+1	20	2800	
							++	+	+	-	-	-	26	4600	
Nakamura (33♂)	1.0	102 (19/IX)	46(19/IX) 224	217 224	1.05	20	+	-	+	-	-	-	48	3500	
							++	-	±	-	-	-	27	2900	
Murakami (34♂)	1.0	37(19/IX)	60(19/IX) 54(24/IX)	291 281	1.03	35	+	-	+	-	-	-		2600	
							++	±	+	-	-	-	18	1700	
	1.0	78(19/IX)	51(19/IX) 51(24/IX)	326 265	0.78	43	+	-	+	-	-	-	20	5600	
							++	+	-	-	-	-	10	7900	
Ishii (23♂)	1.0	95(19/IX)	39(19/IX) 39(24/IX)	157 204	1.24	69	+	-	+	-	-	-		4900	
							++	+	+	+	-	+1	27	5200	
Okamura (24♂)	1.0	82(19/IX)	44(19/IX) 44(24/IX)	161 220	1.06	37	+	-	-	-	-	-	21	4000	
							+	-	-	-	-	-	35	5400	
Kanahara (24♂)	1.0	149(19/IX)	43(19/IX) 43(21/IX)	260 260	0.83	25	+	-	-	-	-	-	10	2300	
							++	++	+	-	-	-	44	3200	
Kuruma (24♂)	0.8	123(21/IX)	50(21/IX) 48(21/IX)	342 294	0.73	22	+	-	-	-	-	-	14	12100	
							++	++	+	-	-	-	31	1700	
Hiyamoto (31♂)	1.0	55(21/IX)	72(20/IX) 60(25/IX)	318 291	1.15	22	+	-	-	-	-	-	10	3500	
							++	-	-	-	-	-	28	3100	
Nomura (20♂)	1.1	155(24/IX)	42(24/IX) 43(25/IX)	207 227	1.01	28	++	+	+	-	-	-	31	3700	
														1700	
Nishihara (23♂)	1.0	104(21/IX)	38(21/IX) 47(25/IX)	249 257	1.16	45	+	+	±	-	-	-		2900	
							++	-	-	-	-	-	28	5800	
Kusaka (22♂)	0.8	86(21/IX)	65(21/IX) 36(25/IX)	269 300	1.20	53	+	-	-	-	-	-	15	2700	
							+	-	-	-	-	-	13	3800	
Muneoka (24♂)	1.2	27(20/IX)	81(20/IX) 65(26/IX)	471 382	0.87	33	-	-	-	-	-	-	14	6000	
							++	±	-	-	-	-	34	9200	
Sakurai (23♂)	1.0		17(21/IX) 57(24/IX)	329 361	1.02	23	+	-	+	-	-	-	5	5400	
							+	±	-	-	-	-	30	9500	
Nishimoto (40♂)	1.0	40(21/IX)	68(21/IX) 51(26/IX)	375 264	0.90	35	+	±	±	-	-	-	23	4600	
							+	-	±	-	-	-	10	5300	
Kinimoto (24♂)	0.8	44(21/IX)	88(21/IX) 55(26/IX)	375 321	1.18	49	+	-	+	-	-	-	15	4500	
							-	+	-	-	-	-	25	3500	
Wada (24♂)	1.0	27(21/IX)	67(21/IX) 57(27/IX)	318 310	1.05	28	-	+	+	-	-	-	11	4000	
							+	±	-	-	-	-	13	6500	
Utsunomiya (44♂)	1.0	113(21/IX)	63(21/IX) 42(27/IX)	338 243	0.93	26	+	-	+	-	-	-	26	9200	
							+	+	-	+	-	-		8900	
Taniguchi (34♀)			31	132									27	2300	
Hatsuda (31♀)			35	179									19	2800	

Blood

Hematophiles				% of White blood cells					Plasma cell	Bleeding time	Coagulation time		Resistance of capillary	Sugar in blood	Hemoglobin in blood	Chloride in blood	Tahara reaction of serum	Bilirubin in serum (direct method)	Bilirubin in serum (indirect method)	T. index	Viscosity of blood	
Neutrophils	Lymphocytes	Band f.	Monocytes	Eosinophils	Basophils	Monocytes	Large	Small			beginning	completion										
-	-	18.0	55.0	0.5	-	6.0	4.0	16.5	0.5	3'30"	6'00"	11'40"	0.40	240	0.089	17.3	378	+	±	-	2.5	-
-	2.0	21.5	42.5	0.5	-	9.0	1.0	23.0	0.5	(23/IX)	(23/IX)	(23/IX)	0.34	240	(21/IX)	(21/IX)	(21/IX)	+	±	-	2.5	-
-	-	12.0	38.0	1.0	-	7.0	18.0	22.0	-	3'00"	7'00"	13'30"	0.46	260 (above)	0.100	16.7	366	±	-	-	4.0	-
-	2.0	3.5	52.5	6.0	1.0	19.0	18.0	5.5	1.0	(24/IX)	(24/IX)	(24/IX)	0.34	260 (")	(26/IX)	(27/IX)	(26/IX)	±	-	-	4.0	-
-	-	14.0	35.5	2.5	-	13.5	11.0	23.5	-	3'30"	4'20"	10'20"	0.40	120	-	-	-	-	-	-	4.0	-
-	-	7.0	51.0	3.0	-	17.0	7.0	13.0	-	(23/IX)	4'30"	7'30"	0.36	140	-	-	-	-	-	-	4.0	-
0.5	1.5	22.0	36.0	1.0	-	9.5	10.5	22.5	0.0	3'30"	5'30"	9'00"	0.42	120	-	-	-	-	-	-	3.5	-
-	-	3.5	69.5	-	-	9.5	2.0	14.5	-	(24/IX)	4'15"	8'15"	0.36	140	-	-	-	-	-	-	3.5	-
-	-	28.0	41.5	-	-	9.5	7.5	13.0	-	2'30"	6'30"	10'00"	0.46	150	0.078	17.2	407	-	-	-	3.0	-
-	0.5	7.5	50.5	1.0	-	10.5	5.0	14.0	1.0	(24/IX)	(24/IX)	(24/IX)	0.36	130	0.078	(21/IX)	(21/IX)	-	-	-	3.0	-
-	-	9.0	40.0	0.5	-	12.5	5.5	31.5	-	2'30"	4'00"	12'00"	0.44	110	0.077	13.8	357	-	-	-	3.0	-
-	-	4.5	30.5	12.0	0.5	13.0	34.5	5.0	-	(24/IX)	(24/IX)	(24/IX)	0.30	130	0.077	(24/IX)	(24/IX)	-	-	-	3.0	-
-	-	22.5	37.5	1.0	-	16.0	9.0	14.0	-	5'00"	4'30"	8'05"	0.40	170	0.051	15.4	347	-	-	-	3.0	-
1.5	1.5	7.5	44.0	5.0	-	16.0	9.0	10.0	-	(23/IX)	(23/IX)	(23/IX)	0.34	180	0.051	(25/IX)	(24/IX)	-	-	-	3.0	-
-	1.5	23.5	39.5	0.5	0.5	13.0	3.5	17.5	-	2'00"	5'20"	14'30"	0.46	200	0.057	14.5	357	-	-	-	2.5	-
-	0.5	13.5	64.0	-	0.5	9.0	8.5	5.0	1.0	(23/IX)	(23/IX)	(23/IX)	0.38	180	0.057	(25/IX)	(25/IX)	-	-	-	2.5	-
-	-	26.0	57.5	-	-	4.5	2.5	9.5	0.5	5'00"	5'30"	21'00"	0.44	220	-	-	-	-	-	-	-	-
-	-	13.0	72.0	0.5	0.5	4.5	5.5	4.0	-	(23/IX)	(23/IX)	(23/IX)	0.32	180	-	-	-	-	-	-	-	-
-	1.0	23.0	41.0	-	-	9.0	6.5	17.5	2.1	2'00"	5'00"	15'00"	0.52	120	0.045	13.3	394	+++	-	-	2.5	-
-	0.5	6.5	57.0	-	0.5	11.0	9.5	13.0	-	(23/IX)	(23/IX)	(23/IX)	0.36	130	0.045	(21/IX)	(21/IX)	+++	-	-	2.5	-
-	-	15.0	63.5	4.5	-	10.0	2.5	4.5	-	3'30"	11'00"	19'00"	0.52	260	-	-	-	-	-	-	3.0	-
0.5	0.5	-	63.5	19.5	0.5	7.0	2.5	3.5	-	(24/IX)	2'12/IX	7'30"	0.32	200	-	-	-	-	-	-	3.0	-
-	-	13.5	24.5	1.0	-	8.5	11.5	41.0	-	3'00"	5'	13'30"	0.46	240	0.064	20.0	333	-	+	-	3.0	-
-	1.0	12.0	37.0	2.1	0.5	14.0	24.0	9.5	-	(24/IX)	(24/IX)	(24/IX)	0.36	240	0.064	(24/IX)	(24/IX)	-	+	-	3.0	-
-	-	17.5	55.0	-	-	9.0	4.5	13.5	0.5	5'00"	10'50"	16'20"	0.46	180	0.091	14.5	419	-	-	-	2.0	-
-	-	21.0	51.0	-	-	6.0	5.0	17.0	-	4'30"	6'30"	11'40"	0.42	240	0.093	15.3	381	-	-	-	3.5	-
0.5	-	9.0	75.5	-	-	6.5	2.5	1.0	-	(24/IX)	(24/IX)	(24/IX)	0.34	210	0.093	(25/IX)	(26/IX)	-	-	-	3.5	-
-	0.5	23.5	36.5	-	-	11.5	10.5	12.5	-	3'00"	7'10"	15'45"	0.44	260	0.091	15.4	357	-	-	-	3.0	-
-	-	12.5	55.0	-	0.5	15.5	14.5	2.5	-	(24/IX)	(24/IX)	(24/IX)	0.32	260	0.091	(27/IX)	(26/IX)	-	-	-	3.0	-
-	0.5	17.0	47.0	-	-	16.0	10.0	15.5	-	3'00"	4'30"	11'30"	0.46	200	0.107	24.0	367	-	-	-	3.0	-
-	-	6.5	67.0	0.5	-	11.5	12.0	2.0	0.5	(24/IX)	(24/IX)	(24/IX)	0.44	200	0.107	(25/IX)	(25/IX)	-	-	-	3.0	-
-	0.5	24.5	32.5	2.5	-	-	7.5	24.0	-	3'30"	4'00"	15'34"	0.44	250	0.088	13.7	364	-	-	-	2.5	-
-	-	10.5	51.5	-	-	15.5	14.5	8.0	-	(24/IX)	(24/IX)	(24/IX)	0.34	250	0.088	(26/IX)	(26/IX)	-	-	-	2.5	-
-	-	17.5	45.0	1.5	-	12.0	12.5	11.5	1.0	6'30"	4'00"	16'00"	0.44	260	0.099	18.6	362	-	-	-	3.0	-
0.5	0.5	15.5	43.5	0.5	-	16.5	25.5	3.5	-	(24/IX)	(24/IX)	(24/IX)	0.44	260	0.099	(27/IX)	(27/IX)	-	-	-	3.0	-
-	0.5	22.5	46.5	1.0	-	3.0	7.0	18.0	1.5	10'00"	7'00"	15'00"	0.44	170	0.101	-	-	-	-	-	2.5	-
-	-	1.0	51.5	0.5	0.5	10.5	16.0	16.0	-	(24/IX)	(24/IX)	(24/IX)	0.32	170	0.101	(27/IX)	(27/IX)	-	-	-	2.5	-
-	-	17.0	49.5	3.5	-	9.5	9.0	11.5	-	3'00"	5'10"	15'20"	0.44	260	0.068	17.8	357	-	-	-	3.0	-
-	-	11.5	63.0	3.0	1.0	6.0	14.0	7.5	-	(24/IX)	(24/IX)	(24/IX)	0.34	260	0.068	(27/IX)	(27/IX)	-	-	-	3.0	-
-	-	9.0	37.0	1.5	-	12.0	8.5	30.0	1.0	3'30"	6'15"	19'00"	0.44	190	0.081	14.5	336	++	-	-	4.5	-
-	-	10.0	38.5	10.0	-	16.5	23.5	17.5	-	(24/IX)	(24/IX)	(24/IX)	0.34	190	0.081	(27/IX)	(26/IX)	++	-	-	4.5	-
-	-	4.5	45.0	-	-	9.0	10.0	30.0	0.5	4'00"	5'30"	9'00"	0.44	260	0.074	18.4	374	-	±	-	2.5	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	5.5	56.0	-	-	6.0	2.0	35.0	1.5	4'00"	2'30"	11'25"	0.44	260	0.078	17.6	379	+	-	-	2.0	-

Urine								Stool							Gastric juice									
Colour	Acidity	Relative weight	Albumin	Sugar	Sediment	Urobilinogen	Urobilin	Diagno-reac-tion	Bile pig-ment	Indican	Occult blood		Trilelet reaction	Parasite eggs	Mucous	Fasting juice		Test material		Occult blood	Lactic acid	Mucous	Typhoid in blood	
											Benzidine	Starch				free HCl.	total acid	free HCl	total acid					
light yellow	neutral	1.006	-	-		++	-	-	-	-	+++	±	±	-										-
"	weak acid	1.014	-	-		±	-	-	-	-	-	-	-	-										-
straw yellow	neutral	1.004	-	-		+	-	-	-	-	-	-		Trichocephalus trichiurus (+)										-
brown	"	1.020	-	-		+	-	-	-	+	+	-	+	-										-
straw yellow	"	1.010	-	-		++	++	-	-	-	-	-	+	-										-
"	"	1.015	-	-		+	+	-	-	-	±	-	+	-			14	26	80	90 (90')	-	±	+	-
light yellow	acid	1.010	-	-		-	+	-	-	-	-	-	+	-										-
straw yellow	neutral	1.015	±	-		-	±	-	-	±	-	-	+	-										-
light yellow	acid	1.012	-	-		-	±	-	-	-	-	-	+	-										-
brown	neutral	1.025	-	-	granulose & gelatin cast as. l. c. epithel. of bladder	+++	+++	-	-	-	±	-	-	Ascaris ++										-
straw yellow	acid	1.025	-	-		+	±	-	-	+	+	-	-	-										-
light yellow	neutral	1.018	-	-		+	-	-	-	-	+	-	-	-										-
brown	"	1.024	-	-		±	+	-	-	+	-	-	+	-			0	0	30	60 (90')	+	-	-	-
light yellow	acid	1.012	-	-		-	±	-	-	-	-	-	+	Ascaris +										-
"	weak acid	1.012	-	-		±	-	-	-	-	-	-	±	-			0	4	0	24 (10')	++	±	+++	-
"	acid	1.022	-	-		-	±	-	-	++	±	-	-	-	-		20	35	110	120 (100')	±	+	+	-
straw yellow	"	1.024	-	-		±	±	±	-	+	+	±	+	-			0	9	54	61 (90')	+	+	++	-
light yellow	weak acid	1.014	-	-		±	-	-	-	-	-	-	+	-										-
"	"	1.015	-	-		±	-	-	-	-	-	-	+	+										-
"	acid	1.020	-	-		-	+	-	-	-	+	-	+	-			8	22	82	40 (70')	-	-	++	-
straw yellow	"	1.028	-	-		-	±	-	-	±	++	++	-	-										-
light yellow	"	1.010	-	-		-	+	-	-	-	±	-	+	Trichocephalus +			4	6	52	68 (90')	-	±	+	-
straw yellow	acid	1.020	-	-		±	-	-	-	±	-	-	-	-			20	36	38	50 (90')	-	-	+	-

Salmonella	Dysentery in stool	Ibc. & induratum	Widal reaction		Blood pressure	Clinical symptoms						Gingivitis	Burn
			1. time (1/X)	2. time (7/X)		Nausea	Epilation	Hemorrhage	Stomatitis	Fever	Diarrhea		
-	-		$\bar{x}(200\pm)$ $\alpha(400\pm)$ $\beta(100\pm)$ OX19 -		105-50	-	+	+	+	+	-	-	-
-	-				110-60	-	+	-	+	+	-	-	-
-	-					+	+	+	+	-	-	+	-
-	-				110-60	-	+	+	+	+	-	+	-
-	-		$\bar{x}(100\pm)$ $\alpha(1600\pm)$ $\beta(50\pm)$ OX19 -		90-50	-	+	+	-	+	+	-	-
-	-		$\bar{x}(100\pm)$ $\alpha(140\pm)$ $\beta(10\pm)$ OX19 -		100-60	+	+	+	+	+	+	+	-
-	-		$\bar{x}(200\pm)$ $\alpha(400\pm)$ $\beta(25\pm)$ OX19 -		120-70	+	+	+	+	+	+	-	+
-	-		$\bar{x}(160\pm)$ $\alpha(800\pm)$ $\beta(50\pm)$ OX19(25 \pm)		110-45	+	+	+	-	+	+	-	-
-	-		$\bar{x}(100\pm)$ $\alpha(1000\pm)$ $\beta(10\pm)$ OX19 -		140-50	+	+	+	-	+	+	+	+
-	-				180-40	-	-	+	+	+	+	+	-
-	-	-			105-55	-	-	+	-	+	-	-	-
-	-				r. 106-0 l. 102-0	+	-	+	-	+	-	+	-
-	-		$\bar{x}(400\pm)$ $\alpha(400\pm)$ $\beta(150\pm)$ OX19 -	$\bar{x}(400\pm)$ $\alpha(50\pm)$ $\beta(100\pm)$ OX19 -	r. 104-42 l. 98-34	+	+	-	-	+	-	+	-
-	-				120-75	+	+	+	-	+	-	+	-
-	-				100-50	+	+	-	-	+	+	-	-
-	-				110-60	+	+	+	-	+	-	-	-
-	-				100-70	-	+	+	-	-	+	+	-
-	-				125-70	-	+	-	-	+	-	+	-
-	-		$\bar{x}(200\pm)$ $\alpha(800\pm)$ $\beta(50\pm)$ OX19(50 \pm)		105-70	-	+	+	+	-	-	-	-
-	-				95-52	+	+	+	+	+	+	-	-
-	-				110-70	-	+	-	+	+	+	+	-
-	-		$\bar{x}(200\pm)$ $\alpha(100\pm)$ $\beta(100\pm)$ OX19(25 \pm)	$\bar{x}(200\pm)$ $\alpha(200\pm)$ $\beta(100\pm)$ OX19(25 \pm)	106-58	+	+	+	+	+	+	-	-
-	-		$\bar{x}(400\pm)$ $\alpha(800\pm)$ $\beta(25\pm)$ OX19 -	$\bar{x}(200\pm)$ $\alpha(400\pm)$ $\beta(200\pm)$ OX19 -	180-68	+	+	+	-	+	-	-	-

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Table 44 Results of oral-surgical investigation

No.	Name	age	sex	Direction of flash	Distance from the center	Location of face	Burns of face	Petechia	Gingival bleeding	Duration of gingival pain	Location of gingivitis	Dental fillings	Degree of swelling & pain	Swelling & pain of submand. lym. gl.	Tongue	Pharynx	Thirst	Salivation	Date of examination	Blood-pictur w.b.c.	r.b.c. hb.	sedimentation time of r.b.c.	
1	Agoru Ueda	32 m.		front	1km.	within		2/IX-12/IX	3/IX-5/IX	3/IX-10/IX	3+3	5mc.	+	+	grey fur	+							
2	Chogo Miyake	38 m.		front	2km.	within		1/IX-10/IX	29/VIII-29/VIII	28/VIII-29/VIII	7+7	5mc.	++	+	grey fur	r.tonsillitis	+		30/IX	2400	1.35m.	30%	
3	Torao Kurushima	36 m.		front	1km.	within		24/VIII-20/IX	15/IX	25/VIII-15/IX	2+2	5,5mc.	+	-	grey fur								
4	Tsutae Okita	25 m.		left front	1km.	within		29/VIII-11/IX	2/IX-10/IX	30/VIII-210/IX	6+1	6gi	++	+	fur				30/IX	2800	2.6m.	38%	
5	Kanae Ikeda	22 m.		left back	1km.	without occiput					3+3	7,6amf. 6,7amg.f.	+	-	fur	+			30/IX	5600	3.26m.	51%	
6	Kazusawa Ikeda	23 m.		back	1km.	within		1/IX-10/IX	27/VIII-30/VIII	27/VIII-30/VIII	6+6		++	-	grey fur	28-30/VIII			30/IX	4500	1.56m.	39%	
7	Takejiro Okomura	24 m.		front	1km.	without		29/VIII-7/IX	28/VIII-11/IX	28/VIII-11/IX	3+3	5,6,7bridge	++	+	fur	28/VIII-30/IX	only the day		30/IX	4000	1.61m.	44%	
8	Iseo Murakami	34 m.		left	1km.	without		31/VIII-5/IX	28/VIII-4/IX	4/IX	2+2	gc. 2+oc	+	-		30/VIII-4/IX	only at the day		20/IX	3600	2.91m.	60%	
9	Yoshichika Nakamura	33 m.		front	1km.	without		2/IX-9/IX	28/VIII-4/IX	28/VIII-4/IX	3+3	gc. 3+	++	-	grey fur	30/VIII-4/IX			30/IX	3500	2.17m.	46%	
10	Kensaku Mochizuki	36 m.		left back	1km.	without		27/VIII-4/IX			4,3+		+	-					20/IX	6400	3.91m.	70%	
11	Tatsuro Kamata	24 m.		left back	0.5km.	within			27/VIII-14/IX	27/VIII-14/IX	2+3	2amf.	++	+	pain fur	2/IX-14/IX			30/IX	2300	2.60m.	43%	
12	Issamu Ito	35 m.		back	1km.	within		30/VIII-4/IX			2+2		+	+	fur	30-31/VIII			7/IX-				
13	Takashi Katsumoto	20 m.		right	1km.	within		30/VIII-4/IX	30/VIII-2/IX	30/VIII-2/IX	1+1,67		+	+	fur	2/IX							
14	Teruo Kuruma	31 m.		right	1km.	within		27/VIII-2/IX	28/VIII-30/VIII	28/VIII-30/VIII	1+1	1mc. 2gc.	+	-	fur	27/VIII-5/IX			21/IX	12100	3.42m.	59%	
15	Yoshio Murasuye	30 m.		back	1km.	within		25/VIII-31/VIII	27/VIII-30/VIII	27-28/VIII	3,2,1+1	6mc. +6amf.	+	+	fur	27/VIII-31/VIII	only at the day		10-13/IX	6700	2.94m.	48%	
16	Isamu Date	19 m.		back	1km.	within					1+1	6amf.	+	-		left side	only the day						
17	Nobuhiko Yamazaki	22 m.		front	1km.	without		27/VIII-7/IX	23/VIII-2/IX	29/VIII-2/IX	6+6	76mc. 532amf. +7amf	+	-	fur	left side							
18	Nao Mino	22 m.		right	1km.	within		25/VIII-3/IX			3+3	6mc. +	+	+	fur	2-5/IX	only at the day						
19	Mamoru Hirai	28 m.		over	1km.	within		2/IX-5/IX	2/IX-13/IX	2-18/IX	2+3	+6amf	+	+	fur	2-4/IX							
20	Moriyuki Nakayama	22 m.		front	1km.	within		1/IX-7/IX	1/IX-15/IX	1-15/IX	2+2	6amf. +	+	+	fur	6-8/IX			30/IX	4600	2.71m.	65%	
21	Hiroshi Shimohara	26 m.		front	1km.	without right side of face		28/VIII-2/IX	3/IX-5/IX	3-5/IX	3+3		+	+	fur	29/VIII-10/IX							
22	Kasao Kusaka	32 m.		front	1km.	within		29/VIII-2/IX	1/IX-3/IX	1-3/IX	2+2		+	-	fur	29/VIII-10/IX							
23	Hazime Hosokawa	25 m.		unknown	1km.	within		27/VIII-9/IX	27/VIII-9/IX	27/VIII-9/IX	2+2	-loc.	+	-	fur	28/VIII-21/IX							
24	Sadashi Harioke	24 m.		unknown	1km.	within		13/IX-18/IX	13/IX-18/IX	13-18/IX	3+3	1-2oc. 3gc.	+	-		3-6/IX			20/IX	6000	4.71m.	81%	
25	Masashi Nagasaki	26 m.		indirect right	0.7km.	within		31/VIII-25/IX	31/VIII-25/IX	31/VIII-25/IX	6,3+3	2oc.	++	+	grey fur	4-5/IX			26/IX	9200	3.32m.	65%	
26	Haruo Miyamoto	37 m.		indirect left	1km.	within		29/VIII-2/IX	14/IX-17/IX	14-17/IX	1+1	loc.	+	-		29/VIII-5/IX			3-4/IX	20/IX	4000	3.22m.	
27	Masayoshi Wada	24 m.		unseen the flash	1km.	within		24/VIII-2/IX	24/VIII-6/IX	24/VIII-6/IX	3+3	-7amc.	++	+	grey fur	14-16/IX			28/IX	3100	3.18m.	72%	
28	Masaharu Sakurai	23 m.		unseen the flash	1km.	without		26/VIII-15/IX	26/VIII-15/IX	26/VIII-15/IX	3+2	7mc. 652lge. + 6mc.	+	-	fur	about 18/VIII			30/IX	5400	3.39m.	59%	
29	Kyuzo Utsunomiya	44 m.		unseen the flash	1km.	within					3+3	76mc. + 6mc.	+	-	grey fur				21/IX	7900	3.30m.	65%	
30	Masaru Kambara	27 m.		unknown	1km.	within		28/VIII-1/IX	18/IX-20/IX	7-9/IX	3+3		+	-	grey fur				27/IX	8200	2.43m.	47%	
31	Kazuo Okamoto	24 m.		indirect	1km.	within		1/IX-28/VIII	9/IX-10/IX	3-16/IX	4+4	+ 6cement f.	++	+	grey fur	28/VIII-6/IX			21/IX	4500	3.75m.	83%	
32	Tokuichi Sugiyama	25 m.		front	1km.	within		10/IX-15/IX	10/IX-15/IX	10/IX-15/IX	4+4,6,8	+ 6mc.	+	-	pain 9-24/VIII	3-13/IX			4-11/IX	26/IX	3500	3.21m.	55%
33	Kozo Yamashina	20 m.		front	0.5km.	within		12/IX-17/IX	12/IX-17/IX	7-16/IX	2+2	6gc. +	+	-	grey fur	25/VIII-5/IX							
34	Takeo Uchi	24 m.		left	1.5km.	within		27/VIII-10/IX			2+2		+	+	grey fur	10-12/IX							
35	Tedashi Shibuya	28 m.		front	1km.	without face				4-6/IX	2+2	-4mc.	+	-	black fur	29/VIII-10/IX							
36	Go Onoda	29 m.		front	1km.	within		4/IX-7/IX	7/IX	3-7/IX	2+2		+	-	brown fur	3 days long							
37	Akira Nakayama	30 m.		left	0.8km.	within		3/IX-7/IX	26/VIII-30/VIII	27-28/VIII	2,1+	7mc. 6gc. 5mc. 1gc. -	+	-	fur	30/VIII-2/IX							
38	Susumu Hosokawa	22 m.		front	0.5km.	within		30/VIII-10/IX	30/VIII-10/IX	30/VIII-10/IX	2+2	5+6mc.	+	-	grey fur	26-30/VIII			21/IX	2900	2.49m.	58%	
39	Aiyomi Motoi	23 m.		right	1.0km.	without right half of face		6/IX-12/IX	10/IX-12/IX	27/VIII-1/IX	8-4+6,7		++	+	yellowish fur	29/VIII-10/IX			25/IX	5800	2.59m.	47%	
40	Toshizo Hamai	22 m.		right front	2.0km.	without right half of face				6/VIII-5/IX	2+2		+	-	fur				18/IX	1200	2.81m.	30%	
41	Nobuichi Yoneda	61 m.		front	1.5km.	without face		25/VIII-30/VIII	6/VIII-10/IX	6/VIII-10/IX	5,4,2	5gc. +	+	+	grey fur	1 week long			30/IX	7600	3.23m.	60%	
42	Junko Tanimoto	34 f.		left	1.0km.	within		31/VIII-7/IX	6-17/IX	6-17/IX	2+2	+456gc.	++	+	grey fur	6/VIII-10/IX				14/IX	1300	1.11m.	16%
43	Shigeo Matsuda	31 f.		front	1.0km.	within		20/VIII-30/VIII	22/VIII-15/IX	25/VIII-30/IX	2+2	2oc. +12oc.	++	+	grey fur	6-10/IX			1/IX	2300	1.63m.	31%	
44	Chiyo Nishii	38 f.		unknown	1.0km.	within		31/IX-15/IX	1/IX-10/IX	1-10/IX	2+2	76mc. 32gc. +123oc	+	-	grey fur	22-27/VIII			13/IX	1300	1.64m.	35%	
45	Hetsuko Misao	53 f.		back	1.0km.	within		27/VIII-2/IX	2/VIII-7/IX	2-5/IX	3+3	6mc. 2oc. +2oc.	+	-	fur	1-10/IX				1/IX	1800	1.27m.	42%
46	Matsuyo Deguchi	61 mf.		left	1.3km.	within		26/VIII-5/IX		24/VIII-5/IX	3+3	21-loc.	+	-	fur	3-4/IX							
47	Saburo Sasamoto	27 m.		right	1.6km.	without right half of face				6-20/VIII	3+3	6gc.	+	-	fur	24/VIII-5/IX							
48	Masaya Abe	24 m.		front	1km.	without face		24/VIII-4/IX	24/VIII-4/IX	24/VIII-4/IX	6+6		+	-	fur	6-15/VIII							
49	Katsushige Sawamura	22 m.		left back	1.4km.	without occiput left cheek		5/IX-			2+4,5	6mc. + 6mc.	+	-	fur	27/VIII-4/IX			12-15/VIII				
50	Yonosuke Kamimura	33 m.		indirect left	1.5km.	within		29/VIII-14/IX		3 11/IX	3+3	6amf. 2oc. +2gi. 8gi.	++	+	grey fur								
51	Seiichi Ito	54 m.		unknown	1km.	within		15/VIII-30/VIII	20-30/IX	20-30/IX	2+4	76amf. +6gc. 7amf.	++	+	fur	2-11/IX			10/IX	4000	3.50m.	54%	

amf. :- amalgam filling
 oc. :- opening crown
 gl. :- gold filling
 gc. :- gold crown
 mc. :- metal crown
 cement f. :- cement filling

Results of pathological investigation in 1st stage

Case Number	Name	Sex	Age	Distance from the Centre (km)	Condition	Day of disease after death	Klinikal-symtomes
3	Sakuma	m.	13	1.0	without stand white shirt	5 1.0 1-	<p>1. Disturbance of consciousness from early stage</p> <p>2. Vomiting (+)</p> <p>3. diarrhoea often and continual high hyperpyrexia from second day</p> <p>4. v.b.c. 9,500</p>
4	Kure	m.	32	1.0	without holdbar stand and put down himself with hot feeling at his back	5 2.0 1	<p>Vomiting continual frequent diarrhoea</p> <p>anorexia and thirstiness</p> <p>feber 38.2-39.0°</p>
5	Yano	m.	39	1.0	within, beside of window under the tumbled house	6 2.0 1	<p>fracture of right tibia bone</p> <p>Contusion and injury of the right shoulder and right chest.</p> <p>burns of face.</p> <p>Vomiting (-)</p> <p>Diarrhoea (+)</p> <p>headach (+)</p> <p>high remittent fever</p>
6	Kimura	f.	13	1.5	without stand white cloth	6 2.0 1	<p>Agitation from 3rd day</p> <p>next stage, disturbance of consciousness.</p> <p>Vomiting, diarrhoea (+)</p>

- I. Bleeding (Petechiae of the pericardium, subepicardium right and palpebral conjunctiva).
- Bloody effusion of the right thoracic cavity.
- Slight dilatation of the right ventricle.
- 2nd degree burn of the face, neck, occiput & back.
- Bleeding and necrosis of the subcutaneous fatty tissue.
- Cloudiness of the liver and kidneys.
- Cloudiness of the myocardium.
- Slight lungemphysema.
- Slight edema of a lower part of the large intestine.
- ascariasis.
- remaining of parenchymal cells of the thymus gland.
- So-called meningitis serosa.
- 3rd degree burn of the face, chin neck, nape of neck, shoulder, extensor side of both forearms and out-side of right thigh
- Haemorrhage of the subepicardium, left visceral pleura and submucosa of the kidney pelvis.
- Cloudy swelling of the liver and kidneys.
- Slight cloudiness of the myocardium.
- Indistinction of the spleen follicles.
- Slight catarrh of the stomach and intestine.
- hypertrophy of the left tonsilla.
- Slight emphysema of lungs.
- Slight atrophy of suprarenal capsules.
- Edema of the lower part of large intestine
- remaining of parenchymal cells of the thymus gland.
- 2nd and 3rd degree burn of the face, neck, left front part of the chest, occiput and back.
- Haemorrhage of subpleura, submucous of the kidney pelvis and myocardium.
- Cloudy swelling of the liver and kidneys.
- lungemphysema.
- Indistinction of spleen follicles.
- Atrophy of lymph glands of whole parts of the body.
- Slight edema of the large intestine
- localized fibrous adhesion of the right thoracic cavity.
- right lacunal tonsillitis.
- Slight cloudiness of pia mater.
- Athelomous change of the first part of aorta.
- Thin abdominal aorta.
- Slight catarrh of intestines.
- Rupture of both temporal lobes of the brain (not larger than a thumbhead) and pretty wide spread hyperaemia and bleeding of pia mater.
- 2nd and 3rd degree burns of the face and right shoulder.
- Subcutaneous total fracture of the right thigh bone.
- Contusion and injury of the right shoulder, right temporal part of head and right chest.
- Cloudy swelling of the liver and kidneys.
- Relative wide spread bleeding and slight catarrh of the mucous membrane of the stomach.
- Petechiae of the epicardium and kidney pelvis.
- Indistinction of spleen follicles with atrophy.
- Slight cloudiness of the myocardium.
- Atrophy of lymph glands of whole parts of the body.
- Slight emphysema of lungs.
- Partly red coloured yellow bone marrow.
- 2nd and 3rd degree burns of the face, neck, nape of the neck, both shoulders, upper part of fore-arms and hands.
- Haemorrhage of the subepicardium, visceral pleura, submucosa of the kidney pelvis.
- Cloudy swelling of the liver and kidneys.
- Indistinction of spleen follicles and atrophy of lymph glands.
- Catarrh and edema of the large intestine.
- Localized fibrous adhesion of the left thoracic cavity.
- Little bloody effusion of the right thoracic cavity.
- Slight congestion and cloudiness of pia mater.
- Gray-yellow coloured and partly yellow bone marrow.
- Ascariasis.
- remaining of parenchymal cells of the thymus gland.

7 Uchiyama f. 34 1.0 washing. 7 5.5 Vomiting and abdominal pain (-)
 m. khaki shirt Brown-black diarrhoea and anorexia (+)
 High continued fever (39°) from 4th day.
 Brain-symptoms about the last day.

1. Rupture of the spleen. Blood (200 c.c.) in the abdominal cavity.
2. Contusion of occiput and the right upper thigh.
3. Hyperaemia and bleeding of the occipital part of pia-mater.
4. Mainly 2nd degree burn of the back, shoulder and occiput.
5. Haemorrhage (pericardium, subepicardium, subpleura, duodenum, stomach, mucosa membrane of kidney pelvis and parenchyma of left kidney).
6. Catarrh of the stomach and intestine, slight edema of intestine.
7. Congestion of both lungs especially of lower lobes.
8. Catarrh of the trachea and bronchus.
9. Primary complex of tuberculous infection of the left lung.
10. Fibrous adhesion of a lower back part of the thoracic cavity.
11. Atrophy of lymphglands and lymphoid apparatus of the whole body.
12. Cloudy swelling of the liver and kidneys.
13. Slight atrophy of the suprarenal capsules and thyroid glands.
14. Mainly yellow, little colloidal changed bone marrow.

8 Hashimoto m. 29 1.2 without 8 1.0 Vomiting (+)
 injured by the tumbled house. Diarrhoea (-)
 Remittent fever from 3rd day
 Anorexia (H)
 No pain in the parts of burns.
 Last stage, agitation and disturbance of consciousness.

1. Sharply marked 2nd and 3rd degree burns of the right half of the face, right chest, right belly and right back with dirty fur and red colored wound border.
2. Relatively fresh and diffuse fibrino-fibrous adhesion of abdominal organs, omentum and peritoneum.
3. Cloudy swelling and slight congestion of the liver and kidneys.
4. Indistinction of spleen follicles with unsymmetrical distribution of blood.
5. One fresh ulcer at the side of large culvatur of oardia with black brown fur and spotted, partly corded submucous bleeding of the stomach.
6. Total and simple fracture of a upper limit of the lower 1/3rd part of the thighbone and contusion and bloody infiltration of the soft tissue.
7. Diffuse and fibroid adhesion of both thoracic cavities. Comparatively obsolete acinous-nodal tuberculosis of the apex of the left lung.
8. Moderate dilatation of the right ventricle of the heart.

9 Sakamoto m. 55 1.5 without

8 2.0 Vomiting, diarrhoea and tenesmus

at the beginning, ~~from 7/1/1~~ some-

times mucous and haemorrhage-
ed stools.

High intermittent fever.

Thirstiness (+)

State of urin 13/VII
albumin (+)
urobillinogen (±)

W.B.C. 7,500 13/VIII

10. Yamamoto f. 24 2.0 without

One-piece

8 2.0 Frequent diarrhoea at the

beginning.

Continued fever about 39.

14/VIII
albumin in the urin (+)
W.B.C. 9,500

Agitation before the last
time, and next stage distur-
bance of consciousness.

9. Petechia of the submucous membrane of the kidney pelvis.

10. Thin marrow of the suprarenal capsules.

11. Mainly yellow bone marrow.

1. 2nd degree burn of the perioral part and right shoulder;
some of them 2/3 mm. others 3/3mm.

2. Many shallow ulcers of the large intestine (from caecum
to the upper part of rectum) with pseudomembranous fur,
erosion and slight edema-like swelling of the mucous
membrane, and notable growth of lymph apparatus of the low-
er part of the small intestine.

3. Ascariasis.

4. Petechiae of the mucous membrane of the stomach.

5. Enlargement of the spleen, mainly caused by marrow-
proliferation.

6. Cloudy swelling of the liver and the left kidney.

7. Fibrous adhesion of the lower half of the thoracic
cavity.

8. Subpleural calcified primary infection of tuberculosis
of the upper lateral part of the left lower lobe ~~of the~~.

9. Petechia of the mucous membrane of the kidney pelvis.

10. Slight atrophy of the suprarenal capsules.

11. Mainly yellow bone marrow.

1. 2nd and 3rd degree burn with desquamated, stretched and black
brown coloured wound surface and with swollen reddish border
wound surface (face, neck, both forearms and both thighs).

2. Haemorrhage (skin, subepicardium, parietal & visceral pleu-
ra, mucous membrane of the kidney pelvis, stomach, intestine
and cortical part of the brain).

3. Slight cloudiness of the myocardium.

4. Universal fibrinous adhesion of the left thoracic cavity.

5. Ossified or calcified tuberculous primary affects of the
left lung.

6. Secondary tuberculosis of lymph glands of the pulmonary
hilus.

12. M.

Komiya m. 33 0.7 without

9 0.7 Vomiting at the beginning.

Frequent diarrhoea from 2nd
day.

High remittent fever.

7. Nutmeg liver.
8. Slight cloudiness of kidneys.
9. Indistinction of spleenfollicles with atrophy.
10. Hyperaemia of the pia mater.
11. Slight catarrh of the stomach and intestine; edema of the large intestine.
12. Dark red colored atrophy of mesenteric lymphglands.
13. Slight atrophy of the suprarenal capsules.
14. Mainly soft and yellow bone marrow.
1. Mainly 3rd degree burn with pretty much secretion and wide wound, covered with crusts here and there (face, left occipital part, right forearm, right chest, left shoulder, right gluteal part and right thigh).
2. Haemorrhage (skin, palpebral conjunctiva, interior side of the endocardium, mucous membrane of the kidney pelvis, stomach, duodenum, epicardium, and the cortical part of the large brain).
3. Fatty degeneration of the liver.
4. Cloudy swelling of the kidney.
5. Indistinction of spleenfollicles.
6. Pseudomembranous inflammation and submucous edema of the intestine.
7. Ascariasis.
8. Dark-red colored atrophy of mesenteric lymphglands.
9. Congestion edema of lungs.
10. Slight hyperaemia of pia mater.
11. Mainly soft and yellow bone marrow.

Results of pathological investigation in 3rd stage.

Case Number of Autopsy	Name	Sex	Age	Distance from the Centre	Condition	Day of disease	Dissect hours after death	Clinical-symptoms	Important Pathological Observation
1	Fujio Tani	m.	4	2.0	without summer-shirt	48	3	1. Anorexia (6/VIII-12/VIII) 2. Hyperplexia (6/VIII-12/VIII) 3. Diarrhoea (6/VIII-20/VIII) 4. Enteral bleeding (5/VIII-15/VIII) 5. Blood-picture (10/IX) W.B.C. 6000 R.B.C. 3.0 m. Hb. 30%	1. Haemorrhage with the lungparenchyma and catarrhal pneumonia of the left lower lobe. 2. Dilation of the right ventricle of the heart. 3. Slight enlargement of the liver and dropsy of the gallbladder. 4. Slight enlargement of the spleen (follicles were not well visible). 5. Pseudomembranous colitis of colon descendens. 6. Leftside gangrenous tonsillitis. 7. Atrophy of the lymphglands of the neck and mesenterium. 8. Red marrow of the right thighbone.
2	Takao Yamamoto	m.	25	0.2	without	47	8	1. Unknown about beginning 2. Hyperpyrexia (17/IX-22/IX) 3. Contusion of right forearm (17/IX) 4. Blood-picture (21/IX) W.B.C. 11900 R.B.C. 1.15 m. Hb. 28%	1. Empyema of the left thoraxcavity and productive tuberculosis of its apex. 2. Fatty heart subepicardial bleeding and cloudiness of the myocardium. 3. Acute purulent pericarditis. 4. Fatty degeneration and slight congestion of the liver. 5. Slight enlargement of the spleen. 6. Dropsy of the gallbladder. 7. Miliary abscess of the kidney. 8. Catarrh of the stomach and intestine and its submucous bleeding. 9. Atrophy of the testicle. 10. Submucous bleeding of kidney, pelvis and urinary bladder. 11. Subcutaneous abscess of the right forearm. 12. Edema of pia-mater.
3	Tadashi Murata	m.	36	0.5	without	48	14	1. Contusion of head (Damage of brain) (5/IX) 2. Disturbance of consciousness (12/VIII) 3. Urinstate (10/IX) Albumin (-) Urobilinogen (-) Indican (+) 4. Stool-state (10/IX) okkult blood (H) ovum of parasite (trichocephalus dispar) (+)	1. Catarrhal pneumonia of the left lower lobe. 2. Abscess of the left frontal lobe of the brain. 3. Fatty heart, subepicardial and subendocardial bleeding of the right ventricle. 4. Atrophy of the spleen. 5. Fatty degeneration of the nutmeg liver. 6. Dark enlarged kidneys. 7. Submucous bleeding of the colon descendens and disappearance of the lymphoid apparatus of the intestine. 8. Catarrh of the stomach and submucous bleeding of the pylorus. 9. Red marrow of both ends of the right thighbone. 10. Edema and cloudiness of pia mater.

4 Shigemi m.21 1.5 without
nobayashi

half bared 57 2

1. Burns (right arm, back, belly)
(83/VIII)
2. Suppuration of burn-warts
(5/VIII)
3. Hyperpyrexia (38°) (10/IX)
4. Blood-picture (30/IX)
w.b.c. 12,500
r.b.c. 3150.
Hb. 45%
5. Urinstate (30/IX)
Urobilin (+)
Urobilinogen (++)
Albumin (+)
Diazo-reaction (+)

1. Atelectasis of the lung and bleeding of both lung and
pleura of different stage.

2. Fatty heart, dilatation of right ventricle and bleeding
of myocardium.

Congestion of chorioideal plexus.

3. Slight congestion of the liver.

4. Slight enlargement of spleen and obsolete infarkt.

5. Grey and slightly enlarged kidneys and submucous bleeding
of the kidney pelvis.

6. Submucous bleeding of the urinary bladder.

7. Macular disappearance of cortical lypoid of the adrenal
organ and its partial bleeding.

8. Submucous bleeding of the pylorus, small intestine &
Rectum.

9. Atrophy of testicles and thyroid glands.

10. Bleeding within posterior mediastinum.

11. Red marrow of the upper part of thighbone and colloidal
one of lower part of it.

12. Increase of cerebrospinal fluid of the brain-ventricle.

1. Atelectasis of both lungs and bleeding of both lung
and pleura

2. Nutmeg liver with fatty degeneration (not so severe).

3. Atrophy of spleen, distinguishment of follicles.

4. Macular discoloured kidneys.

5. Atrophy of suprarenal capsules.

6. Pseudomembranous colitis of high degree of colon
descendens, indistinctness of the lymphoid apparatus of
intestine.

7. Submucous bleeding of the triangular part of the vesicle.

8. Atrophy of testicles.

9. Rightside gangrenous tonsillitis.

10. Fracture of the right thighbone with bad callus formation
and burn.

11. Alopecia of scalp hair (frontal and occipital part).

Fibrinous pleurisy and localized leftside haemothorax.

Bleeding of both lung and pleura.

2. Subepicardial bleeding of the front part of the left ventricle
of the heart. Claudiness of the myocardium of high degree.

3. Atrophy of the liver and its fatty degeneration.

4. Atrophy of the spleen.

5. Graaf-red coloured contracted kidneys and submucous bleeding
of the kidney pelvis.

6. Spotted disappearance of the cortical lypoid of suprarenal
capsules.

7. Catarrh of the stomach and the intestine.

8. Atrophy of the tonsilla.

9. Congestion of the thyroid gland.

10. Edema and 3 degree burn of lower extremities.

5 Toshita- m.39 1.0 within
ro
Mittani shirt

48 12

1. Anorexia (10/VIII-18/VIII)
2. Weariness (10/VIII-18/VIII)
3. Diarrhoea (7/VIII-28/VIII)
4. Alopecia (25/VIII-3/IX)
5. Sore throat
6. Sweat
7. Blood-picture
w.b.c. 9,100 (18/IX)
8. Blood-picture (18/IX)
w.b.c. 38,000
r.b.c. 4,700
Hb. 70%

12. Increase of cerebrospinal fluid of the brain-ventricle.

1. Atelectasis of both lungs and bleeding of both lung
and pleura

2. Nutmeg liver with fatty degeneration (not so severe).

3. Atrophy of spleen, distinguishment of follicles.

4. Macular discoloured kidneys.

5. Atrophy of suprarenal capsules.

6. Pseudomembranous colitis of high degree of colon
descendens, indistinctness of the lymphoid apparatus of
intestine.

7. Submucous bleeding of the triangular part of the vesicle.

8. Atrophy of testicles.

9. Rightside gangrenous tonsillitis.

10. Fracture of the right thighbone with bad callus formation
and burn.

11. Alopecia of scalp hair (frontal and occipital part).

Fibrinous pleurisy and localized leftside haemothorax.

Bleeding of both lung and pleura.

2. Subepicardial bleeding of the front part of the left ventricle
of the heart. Claudiness of the myocardium of high degree.

3. Atrophy of the liver and its fatty degeneration.

4. Atrophy of the spleen.

5. Graaf-red coloured contracted kidneys and submucous bleeding
of the kidney pelvis.

6. Spotted disappearance of the cortical lypoid of suprarenal
capsules.

7. Catarrh of the stomach and the intestine.

8. Atrophy of the tonsilla.

9. Congestion of the thyroid gland.

10. Edema and 3 degree burn of lower extremities.

7 Fuji m.68 1.8 without
Kawakami f. Mante
One-piece

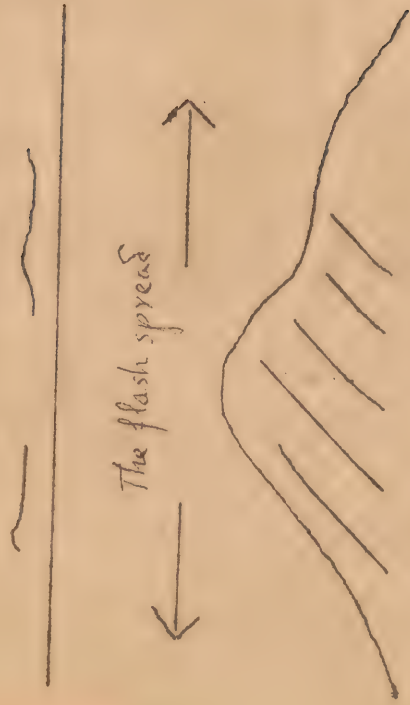
51 12

1. Burns (face, both arms and
both thighs) (8/VIII)
2. Oliguria (29/IX-6/X)
3. Moist rale (29/IX-6/X)
4. Blood picture (28/IX)
w.b.c. 4,600
r.b.c. 3,490.
Hb 38%
5. Stool-state (27/IX)
Occult blood (-)
Ovum of parasite (-)

Table No. 50 by Dr. Makino

No.	Name	Age	Sex	Birth date (approx.)	Birth date (approx.)	Age	Weight	Height	Education	Diagnosis	Hygiene	Health	General	Special	Notes	Behavior	Notes	Behavior
1	Kuniso Oshida	67	M.	2/11 4600	3/85 m	74	260.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
2	Tsutomu Takai	59	M.	2/11 4500	3/58 m	72	230.000	172	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
3	Takako Tanaka	14	F.	2/11 4500	3/58 m	72	230.000	172	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
4	Tetsuo Noda	39	F.	5/10 4520	4/52 m	77	240.000	177	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
5	Yukie Hakano	46	F.	5/10 4500	4/82 m	76	240.000	176	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
6	Seichi Tanaka	49	M.	5/10 4500	4/82 m	76	240.000	176	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
7	Kame Noda	57	F.	6/40 4500	3/25 m	61	240.000	175	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
8	Seichi Tanaka	61	M.	8/00 4500	4/38 m	73	250.000	173	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
9	Boku Ishida	32	M.	8/60 4500	3/82 m	72	240.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
10	Suguru Miyamoto	44	M.	2/11 3600	4/32 m	59	170.000	166	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
11	Tsutomu Nakagumi	30	M.	2/11 2900	4/44 m	70	280.000	170	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
12	Kaichi Yamaguchi	48	M.	2/11 4900	4/16 m	63	150.000	163	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
13	Mamoru Oshida	44	M.	4/30 4500	5/28 m	86	250.000	175	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
14	Yoshio Miyamoto	46	M.	6/40 4500	5/06 m	93	300.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
15	Shigeru Tsuchimoto	41	M.	7/60 4500	4/70 m	85	360.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
16	Kishio Tanaka	43	M.	6/40 4500	4/24 m	81	300.000	173	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
17	Minezo Miyamoto	59	M.	2/11 4500	4/12 m	67	240.000	173	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
18	Misao Yamaguchi	51	F.	8/10 4500	4/15 m	72	340.000	172	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
19	Idiayuki Miyamoto	14	M.	10/20 4500	4/51 m	64	170.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
20	Tatsuo Miyamoto	31	F.	2/11 1400	4/18 m	72	170.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
21	Yoshio Miyamoto	52	M.	8/20 4500	4/64 m	77	310.000	177	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
22	Kunichi Oshida	55	M.	6/60 4500	2/58 m	57	240.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
23	Shota Yoshida	47	M.	3/80 4500	4/98 m	74	400.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
24	Mamoru Noda	40	M.	4/40 4500	5/12 m	41	350.000	174	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
25	Tetsuo Oshida	53	F.	3/60 4500	3/72 m	73	240.000	173	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
26	Taro Miyamoto	62	M.	5/75 4500	5/07 m	95	210.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
27	Sue Kunimura	54	F.	8/10 4500	3/44 m	65	300.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
28	Wakano Yoshida	51	F.	3/20 4500	3/48 m	63	230.000	173	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
29	Kana Tanaka	49	F.	7/00 4500	4/38 m	81	230.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
30	Kita	32	F.	8/40 4500	3/46 m	67	240.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
31	Shuichi Uzuma	51	M.	5/60 4500	5/00 m	71	470.000	172	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
32	Mitsuru Tanimoto	34	M.	7/50 4500	4/16 m	82	250.000	175	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
33	Yuzuru Yamaguchi	70	M.	5/80 4500	4/98 m	95	210.000	171	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
34	Tametsu Noda	58	M.	7/60 4500	4/18 m	32	270.000	178	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
35	Seichi Tomiyama	35	M.	1/98 00	2/40 m	50	180.000	130	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi
36	Ido Rokushiro	31	M.	4/40 4500	4/12 m	84	120.000	175	1/10	1/10	1/10	1/10	1/10	1/10	1/10	at Koi	at Koi	at Koi

1. Soon after the explosion



2. a few seconds after 1.

The yellowish light converged to center & vanished



View of smoke from Kure

3. a several seconds after 2.

Bluish milky smoke rose up.

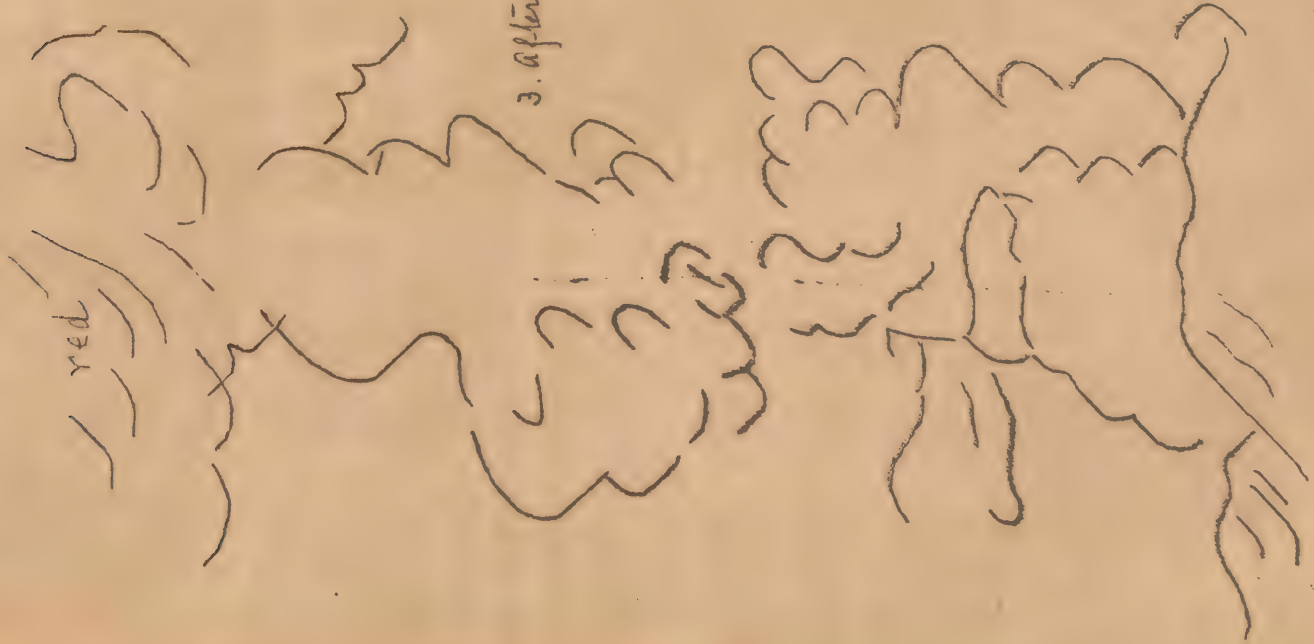


4. after 20 seconds

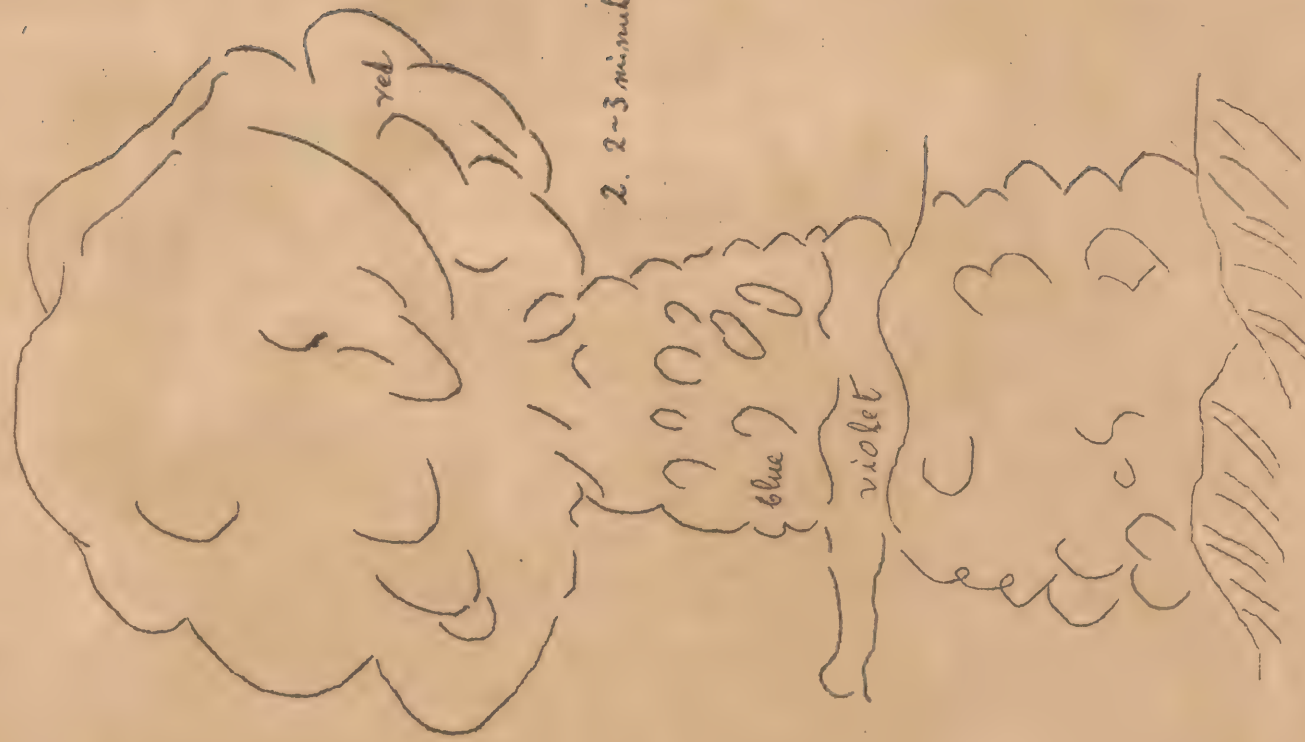
The smoke rose quickly & violently



Another View of the smoke from X-102
(from Northside of the Harguine)



30 minutes after



2. 2-3 minutes after



1. Soon after the explosion

Burn



Radiation Disease



Petechia & Depilation



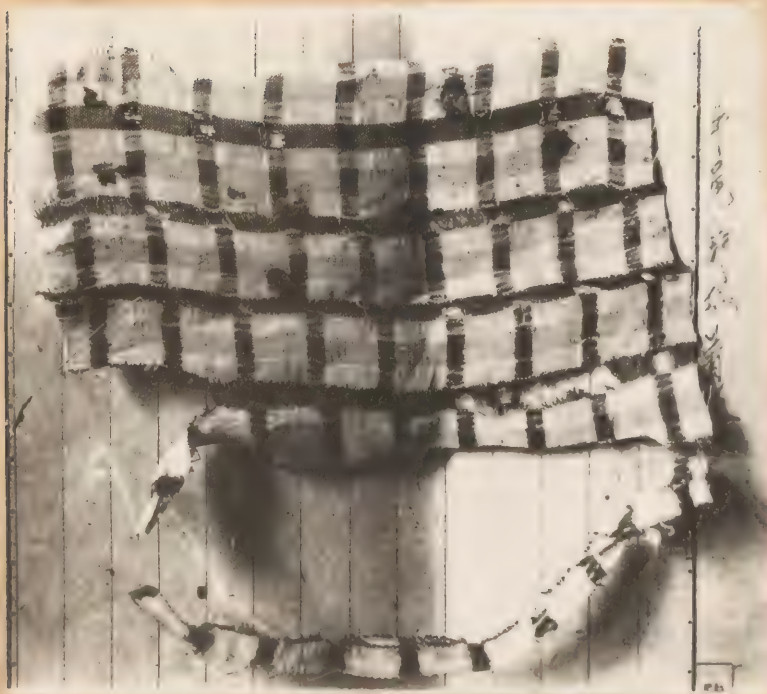
Stomatitis



Gingivitis

Apparel & Burn

S.Ushio female



Her one piece with black & white strips



Burn in the corresponding stripes

